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## SKETCH OF THE PROGRESS OF NORTH AMERICAN ICHTHYOLOGY IN THE YEARS 1880–1881.

BY W. N. LOCKINGTON.

THE amount of ichthyological work that has been done in the United States during the years 1880 and 1881 is exceptionally large. The greater portion of this work consists of descriptions of new species and additions to our knowledge of the geographical and bathymetrical range, habits, food and other data of economic value. A considerable portion of this work is the results of the U. S. Fish Commission conjoined with the census. Upon the Atlantic coast the steamer *Fish-hawk* has been engaged in dredging in the deeper waters, and among the resulting crowd of forms new to science, have been several fishes. Upon the Pacific coast, the special commissioners sent out, although unprovided with dredging apparatus, and dependent for their specimens entirely upon the supplies obtained by fishermen, and what they could themselves collect with the simple appliances at hand, have added vastly to the number of species known, and have conclusively proved that the Pacific shores are at least as rich in animal life as the Atlantic. Great additions to the fauna of our western coast may again be looked for whenever research in the deep waters is commenced. Unexpected additions to the fresh-water fish fauna have also been made in various parts of the country, and numerous species from Lower California and the more southern parts of the west coast of Mexico have been described.

Comparatively few have, during this period, worked in systematic, anatomical and embryological ichthyology. The tempting harvest of new forms still detains many of our naturalists in the easier walks of descriptive zoölogy, and the knowledge that the

work of description is far from exhausted, has a deterrent effect upon monographers.

At least 124 species hitherto unknown to science have been added to the faunal lists of our Nearctic continent during the past two years, and the probabilities are that the actual numbers exceed this, for so rapidly is the work proceeded with, and so extensive is the field, that it is not unlikely that some species have been described in advance sheets of the proceedings of societies, which have as yet not issued their completed volume, and thus have escaped the notice of the writer.

The Proceedings of the U. S. National Museum for 1880, are almost entirely occupied with ichthyological papers. The principal contributors are Professor D. S. Jordan and his coadjutor, Mr. C. H. Gilbert, Professor G. B. Goode, W. N. Lockington and Professor O. P. Hay. The two former ichthyologists have no less than thirty-seven papers, in which forty-nine new species are described, all from the Pacific coast, U. S. The total number of fishes enumerated from that coast is 270, of which all but fifteen were obtained by the writers, who during 1880 represented the U. S. Fish Commission in California. Seventeen previously known species were added to the fauna of California, principally sharks, making a total of twenty-eight species common to the Atlantic and Pacific oceans. In the preparation of this list priority of publication has been strictly regarded, and we thus regretfully witness the substitution of Scomberomorus for Cybium, of Tylosurus for Belone, and of Stolephorus for Engraulis, while the familiar quinnat or Californian salmon is exchanged for the "tshawytcha" or "chouicha." The species of Sebastichthys or rock cod, are twenty-five, fifteen of which are new. Eight species are added to the flat fishes, three to the Embiotocidæ and six to the rays, while the Paralepidæ and their relations are increased from one to five. Several nominal species are eliminated from the Lophobranchs, Gasterosteidæ and Petromyzontidæ. Among the most interesting discoveries may be mentioned that of a true sole (*Aphoristia atricauda*), a "puffer" shark (*Catulus ventriosus* Garman), three Blennidæ of the genera Xiphister and Apodichthys, a cottoid devoid of ventral fins (*Ascelichthys rhodorus*) and *Nemichthys avocetta*.

In "Notes on a collection of Fishes from Utah lake," the same writers describe three new species of fishes.

The Proc. U. S. Nat. Mus. for 1881, contains descriptions of forty new species from Mazatlan, thirty from Panama and a few others from the Gulf coast, all by the same hard-working ichthyologists.

In the same volume Mr. C. L. Mackay reviews the genera and species of Centrarchidæ, and describes a new species of Lepomis.

W. N. Lockington (Proc. U. S. Nat. Mus., 1880) describes ten new species of fishes from various parts of the Pacific coast, the most noticeable of which are *Prionotus stephanophrys*, taken near San Francisco; *Myriolepis zonifer*, a singular Chiroid, and the curious soft-boned *Icosteus ænigmaticus*, for the reception of which and his own *Icichthys lockingtoni*, Professor Jordan subsequently instituted the family Icosteidæ. In the long low dorsal and anal, as well as in the extreme flexibility of the skeleton, these species agree, but while Icosteus is scaleless, with groups of spinules along the lateral line and spinules upon the fins, Icicthys is entirely scaly and without spinules.

The same writer (Proc. Phil. Acad. Nat. Sci.) describes some new species from the Gulf of California, and a Catostomus from the Gila.

Miss Rosa Smith describes a Cremnobates and a Gobiesox from Southern California.

Dr. T. H. Bean (Proc. U. S. Nat. Mus., 1880) describes a new hake from South Carolina, and in the same volume S. Garman gives a synopsis of the American Rhinobatidæ, and Professor Jordan notices a new Caranx from S. Carolina.

S. Th. Cattie, of Arnheim, Holland, also contributes some information respecting the structure of the organ of Syrski in the male eel, and the external characters of the sexes in that fish; and Professor O. P. Hay describes fifteen new species from the eastern part of the State of Mississippi, from affluents of the Mississippi and Tombigbee, and from the Chickasawha. Eight of these species (including the new genus Opsopœodus) are Cyprinidæ, the remaining seven Etheostomatidæ.

The U. S. Coast Survey Steamer *Yukon* proceeded, in 1880, along the coast of Alaska, calling at various points to make collections. The expedition was accompanied by Dr. W. H. Dall and Dr. Tarleton H. Bean, the latter of whom made a valuable collection of fishes, of which he gives a preliminary description

in the Proc. U. S. Nat. Mus., 1881. The new species enumerated are thirteen in number, without counting one taken only at Plover bay, Siberia. The most singular of these new forms is the serpentiform *Ptilichthys goodei*, allied to the Mastacembelidæ. The dorsal consists in front of many isolated spines, with a posterior, many-rayed soft portion, the mandible terminates in a skinny appendage, and the tip of the tail is free. The same naturalist, together with Professor Goode, describes *Apogon pandionis*, a deep-water fish from the mouth of the Chesapeake.

During his stay upon the Pacific coast, Professor Jordan thoroughly investigated and cleared up the mystery in which the species of the genus Oncorhynchus (Pacific salmon) had been wrapped by a crowd of naturalists who at various times had described as distinct, forms which have now been proved to be due to age, sex or season. There are only five species, the quinnat, chouicha, or king salmon, the most important of all from an economic point of view; the blue-back, or red-fish, *O. nerka*, examples of which, found high in the rivers and in the lakes, have long figured as a distinct species from their brethren of the lower waters; the silver salmon, *O. kisutch;* the fall salmon, *O. keta*, and the dog salmon, *O. gorbuscha.*

Professor S. A. Forbes[1] describes a Chologaster from the southern part of Illinois, it agrees with *C. cornutus* in position of eye and plan of markings, and with *C. agassizii* in length of pectorals and structure of scales.

Mr. S. Garman,[2] whose special studies have added so much to our knowledge of the Selachians, has, during these two years, described two new species of Scyllium, one of Rhinobatus, one of Trigonorhina, two of Trygon and two of Raja, most of them from the Atlantic coast. Seven species of Trygon proper are now known to occur in America. Mr. Garman believes that the migrations of the Selachians, as also those of fishes, which the former follow in pursuit of their food, are much more limited in extent than has usually been supposed. Many species do no more than take short trips to deeper water and back again, and were methodical observations conducted for the purpose, it would be quite possible for our knowledge of the migrations of fishes to be extended so that the fisherman could follow his game as the hunter does his.

[1] AMER. NAT., March, 1881, p. 232.

[2] Bulletin Museum Comp. Zoology, Cambridge, 1880–1881.

The same zoölogist has also described eleven species of Cyprinodontidæ, Cyprinidæ and Catostomidæ from the various parts of North America.

On the Atlantic coast the labors of the Fish Commission have added several new species to our fauna. Professor G. B. Goode (Proc. U. S. Nat. Museum, Nov., 1880) describes seven new species of fishes that were the result of a single day's work of the *Fish-hawk* at the edge of the Gulf Stream in Southern New England. In this one day 120 species of invertebrates and fishes were added to the fauna of the region south of Cape Cod. The two new Pleuronectidæ are ranged under as many new genera, and the genus Hypsiconetes is instituted for a species which is apparently gadoid, but in some respects resembles the blennioids. The same naturalist contributes to the Bulletin of the U. S. Fish Commission, 1881, an account of the habits, range and economic values of the carangoid fishes, pompanoes, crevallés, amber fish, etc., of the Atlantic coast; and also a digest of the recent literature upon the life-history of the eel. There appears to be but little doubt that the organs of Syrski are the testes, but no one has as yet observed the spermatozoa in the common eel. Mr. Goode, however, has omitted any reference to a paper in this journal (Vol. XIII, May, 1879, p. 319) by Professor A. S. Packard, Jr., and J. S. Kingsley, who were the first to discover the male eel in America, three specimens having been obtained at Wood's Holl, while Mr. Kingsley claims to have seen the spermatozoa.

Dr. Theodore Gill, in his review of Dr. Günther's Introduction to the study of Fishes, severely criticises the latter's definition of a fish, and also the bibliography. The treatise is valuable from the thorough acquaintance with both external and internal characters which it displays.

Dr. Franz Steindachner (*Ichthyologische Beitrage* IX, Sitz. kais. Akad. Wiss., Wien, July, 1880), describes two species of Agonus from California, which have been shown to be identical with two species of Brachyopsis *(Agonus pars)* described a short time before by Lockington and Jordan respectively. The description is accompanied by figures. In No. XI of the same series (1881), Dr. Steindachner describes *Trichodon japonicus*, which ranges from Japan to Sitka.

Mr. Henry J. Rice (AMER. NAT., Jan., 1880) contributes a valuable article upon tbe habits, structure and development of *Am-*

*phioxus lanceolatus*, as observed by him in three adults taken at Fort Wool in twelve to fifteen fathoms of water, and in twenty young secured by surface dredging. The lancelet swims with a graceful, undulating motion, and can disappear from sight beneath the sand almost instantaneously. It swims indifferently upon back or belly, and when excited is able to dart about with extreme rapidity. The writer believes the ova to issue from the branchiopore, and states that it is questionable whether the anterior pigment-spot of the spinal cord is of any more value than any of the other pigment-spots of the nervous system.

The question, "Do flying fish fly?" is answered in the affirmative by C. O. Whitman, who declares that during a voyage from San Francisco to Yokohama, he several times distinctly saw the individual flaps of the large pectorals, while the ventrals were held in quiet expansion. The longest flight observed lasted forty seconds, and was certainly over eight hundred feet.

The principal, almost the only contributor to the embryological knowledge of fishes, has been the indefatigable J. A. Ryder, of the Fish Commission. In the course of his investigations during the past year, he has elucidated many points in the developmental history of the shad, cod, salmon, top-minnow, stickleback, sea-horse, garfish and other fishes. The range of his observations has, in fact, been sufficiently extensive to warrant him in arriving at certain general conclusions, some of which contravene those of previous observers. When it is remembered that the only material at the command of most biologists who have worked upon the eggs and embryos of fishes, has been preserved in spirits for more or less time, while Professor Ryder has all along been supplied with fresh material in large quantity through the Fish Commission, it will be evident that his conclusions are entitled to great weight. He finds that in the Teleostean fishes and in sturgeons, the segmentation-cavity is not obliterated, but gradually thins out and grows around the yelk between the epiblast and hypoblast, forming a paravitelline space which persists for at least two weeks after the embryo leaves the egg. Around the edge of the blastoderm a thickened rim or annulus is developed in both the types above mentioned, and limits the paravitelline cavity. The cleavage of the germ disk is regular, but the embryo agrees with that of the Selachians in developing at the edge of the disk, instead of in the center as is the case in birds and reptiles. A

vesicle appears at the tail end of the embryo when the blastoderm has rather more than half surrounded the vitellus, and this vesicle is almost certainly the result of the invagination of the gastrula mouth or blastopore. From this vesicle, known as Kupffer's vesicle, a canal proceeds forwards and opens on the dorsal face of the embryo. The gastrula of teleostean fishes is thus the result of an invagination at the tail, essentially as in Amphioxus, and is not homologous with the gastrula of Haeckel.

The pectoral fins originate from lateral folds, and their first skeletal elements are a pair of cartilaginous rods which are not placed radially, but are concentric with the base of the fin. These folds vary in their position, but are placed so far back that their genetic relation to the gill-arches appears improbable. The position of the fin becomes more anterior with the growth of the embryo, and in the cod the base rotates through an angle of nearly 90° to gain its upright position. The shoulder girdle is of mesoblastic origin.

The median unpaired fins originate from a dorsal and ventral natatory fold, which may be continuous, discontinuous from the very first (Hippocampus), or discontinuous at an early stage. The vent of the young fish appears long before the mouth; the intestine develops from behind forward, and it is probable the intestine and medullary canal are primitively continuous by means of a neurenteric canal.

The investigations of Professor Ryder show wide differences in the order and manner of development of the various organs; differences of a nature to show that embryology alone is a most unsafe basis for classification.

In the four-spined stickleback the cerebral vesicles are extraordinarily large and the walls of the brain cavity very thin; the optic cups have a great space between the floor of the cup and the lens; the pectoral folds originate unusually near to the gill-arches, and when the young fish leaves the egg, are as much developed as in a mackerel four days old; and there is an asymmetrical vitelline system of blood-channels. The corpuscles appear to originate by budding off from knobbed cells of the hypoblast of the venous sinus.

The nest-constructing habits of the sticklebacks have long ago been noticed, but from the observations of Mr. Seal and Professor Ryder, it is now known that the male possesses a special spinning

gland on the right side of the intestine, and that the stalks of water weeds and other objects of which the nest is constructed, are bound together by compound threads of six or eight fibers spun by him in a fitful way as the material is secreted.

The egg-membranes of floating fish ova, as those of *Cybium maculatum*, are extremely thin, and pierced only by the micropyle, not perforated by pore canals as is the case with ova, which like those of the stickleback, salmon and shad, sink to the bottom. The ova of *C. maculatum*, the Spanish mackerel, are hatched in twenty-four hours after fertilization, and the young are then in a very rudimentary state.

The gills of the so-called Lophobranchiates are not really tufted, but the two series of vascular branchial appendages to each arch in Hippocampus are homologous to the bifurcated vascular branchial appendages of a salmon or other fish. But these appendages are much reduced in number, and, as if to compensate for this, the area of the ultimate branchial lamellæ or pinnæ ranged upon them is extended, and these leaflets increase in size outwards, producing a tufted appearance. In all Lophobranchs the branchial arches are reduced, the opercle is a simple plate, the mouth is toothless, and the opercular membrane persistently roofs over the gill chambers of the embryos.

Experiments upon the retardation of the development of the ova of the shad, with the end of ascertaining the possibility of transporting them alive for long distances, were not successful on account of the development of fungus, but in four and a half days the ova at a temperature of 52° F., had not advanced farther than they would have done in water at 80° in twenty-four hours.

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## METHODS OF MICROSCOPICAL RESEARCH IN THE ZOOLOGICAL STATION IN NAPLES.

BY C. O. WHITMAN.

*(Continued from September number.)*

### II. Staining Methods.

IT has gradually become a settled custom in the Zoölogical Station, to mount microscopical preparations in balsam wherever this can be successfully done; and to avoid, as much as possible, the use of aqueous media, both in mounting and staining. The disadvantages often arising from the use of these media in stain-

ing alcoholic preparations, such as the tearing asunder of fragile tissues caused by the violent osmosis; swelling, the effects of which cannot always be fully obliterated by again transferring to alcohol, and maceration, which is liable to result where objects are left for a considerable time in the staining liquid, may all be avoided by using alcoholic solutions. Objects once successfully hardened may be left in such solutions for any required time, and when sufficiently stained, be washed in alcohol of a corresponding strength, and then passed through the higher grades without being exposed to water from first to last. As a rule, alcoholic dyes work quickly, and give far more satisfactory results than can be obtained with other media. They penetrate objects more readily, and thus give a more uniform coloring where objects are immersed in toto. Even chitinous envelopes are seldom able to prevent the action of these fluids.

It is not, however, to be denied that non-alcoholic dyes may often do excellent work, and in certain cases, even better than can be otherwise obtained. In the case of the Turbellaria, Dr. Lang has found picro-carmine to be one of the best staining agents, and this has been my experience with Dicyemidæ. As Dr. Mayer has remarked, the swelling caused by aqueous staining fluids is not always an evil, but precisely what is required by some objects after particular methods of treatment.

From experiments recently made, Dr. Mayer has found that dyes containing a high percentage of alcohol, stain more diffusely than those of weaker grades, from which he infers that strong alcohol robs, to a certain extent, the tissues of their selective power, and renders them more or less equally receptive of coloring matter.

1. *Kleinenberg's Hæmatoxylin.*[1]—1. To a saturated solution of chloride of calcium[2] in 70 per cent. alcohol, add a little alum and filter.

2. One volume of No. 1 mixed with six to eight volumes of 70 per cent. alcohol.

3. At time of using pour into No. 2 as many drops of a con-

[1] May be used after all hardening fluids.

[2] Chloride of calcium, according to Kleinenberg, has no other use than to strengthen the osmotic action between the hæmatoxylin solution and the alcohol contained in the tissues. As chloride of calcium and alum give a precipitate of gypsum, it would probably be better to use *chloride of aluminum.*

centrated solution of crystallized hæmatoxylin in absolute alcohol as suffice to give the required depth of color.[1]

If the color appears too strong, the fluid may be diluted with solution No. 1.

Before immersing objects in this fluid, great care should be taken to free them from the least trace of acid by frequently changing the alcohol. If this is not done thoroughly, the acid left in the preparation will sooner or later cause the color to fade; and such results have led to the erroneous conclusion that hæmatoxylin will not give durable preparations. Dr. Mayer has found that the fading is entirely due to the presence of acid, and that with proper precautions the staining is permanent.

Small objects are best stained in a weak solution, which colors more slowly but with greater clearness than stronger solutions. After staining, Kleinenberg transfers objects to 90 per cent. alcohol. In case of over staining, the color may be partly removed by adding a little *oxalic acid* or *hydrochloric acid* (½ per cent. or less) to the alcohol containing the objects. The acidulated alcohol is allowed to work until the color is slightly reddened. On transferring to pure alcohol the color passes again into a permanent blue-violet.

2. *Mayer's cochineal tincture.*—1 gramme powdered cochineal soaked in 8–10 ccm. 70 per cent. alcohol for several days, then filtered.

The clear deep red fluid thus prepared may, like hæmatoxylin, be used in all cases where it is desirable to stain with an alcoholic solution, and will be found particularly useful for objects that are not easily penetrated by the ordinary aqueous solutions of carmine, such as the Arthropods.

It is necessary, before immersing larger objects in this fluid, to leave them a short time in 70 per cent. alcohol, otherwise there may be a precipitate. The time required for staining, will vary from a few minutes to even days, according to the nature and size of the object. With larger objects requiring considerable time,

[1] A good solution should be violet inclining a little to blue. The red tinge that arises after the fluid has stood for some time, indicates that it has become slightly acid, in which condition it is unfit for use. To restore its proper color, it is only necessary to open a bottle of ammonia over the mouth of the bottle holding the hæmatoxylin in such a manner that a very small quantity of the gas will mix with the fluid. If too much ammonia gas be added, a precipitate is produced which spoils the fluid.

it is important to use a large quantity of the fluid, otherwise the amount of coloring stuff in solution might not suffice to give the proper depth of color. Small and delicate objects, on the other hand, may be most successfully treated with a solution which has been diluted with 70 per cent. alcohol, or one which has been weakened by previous use. It is always necessary to free the tissues, after staining, from the surplus dye; and this may be done by washing in 70 per cent. alcohol, which must be changed until it shows no color. This process requires, for larger objects, considerable time and alcohol, but may be hastened by using the alcohol slightly warm.

The color ultimately assumed by objects treated with cochineal tincture varies much, and depends partly on the reaction of the tissues themselves, partly on the presence or absence of certain salts. It is certainly one of the best recommendations of this staining agent that, varying with the nature of the object and its mode of treatment both before and after staining, it gives such an extraordinary diversity of results. On account of the great variety of substances contained in the dried dye-stuff, it is evident that the composition of the tincture must vary according to the strength of the alcohol employed as a solvent. Solutions in 90 per. cent. or 100 per cent. alcohol have a light red color, and stain too diffusely to have any practical value. The weaker the alcohol the stronger the tincture, and the stronger the alcohol the more easily it penetrates objects; the grade of alcohol may therefore be selected with reference to two points, depth of color and readiness of penetration; 70 per cent. or 60 per cent. is recommended by Dr. Mayer as combining both these qualities in a very favorable degree. It is important to remember that whatever be the strength of the solution, a precipitate will always be produced if an alcohol of a different grade, whether higher or lower, be mixed with it. It is evident then that a tincture of any given strength contains substances that are insoluble in any other grade of alcohol, and this explains why superfluous coloring matter can only be removed from objects by the aid of alcohol of precisely the same degree as that of the tincture.

Over staining, which seldom occurs, may be easily corrected by the aid of acid alcohol ($\frac{1}{10}$ per cent. hydrochloric acid, or 1 per cent. acetic acid). Acid makes the tincture lighter, more yellowish-red, while the addition of ammonia and other caustic alkalies

changes it to deep purple. Still more important is the fact that salts soluble in alcohol give a blue-gray, green-gray or blue-black precipitate. For example, if a piece of cloth that has been dyed in cochineal and washed, be treated with an alcoholic solution of a ferric or a calcic salt, it will assume a more or less deep blue color.

As the salts present in the living organism are seldom, if ever, fully removed by preservative fluids, but in some cases even increased, it will often happen that an object, though stained in the red fluid, comes out blue, precisely as when stained with hæmatoxylin. Such a result cannot, however, be obtained in the presence of acids, nor in the absence of inorganic salts; under these conditions the color is always red. It is not possible, therefore, to know what color an object will ultimately present.

Very often the different tissues of one and the same object present unlike colors. In the embryos of Lumbricus, Kleinenberg found the walls of the blood vessels red, their contents dark blue. Glandular tissues, or their contents, are frequently stained gray-green.

Objects treated with chromic or picric solutions, or with alcohol, usually stain without difficulty; but osmic acid preparations should be bleached before staining. Cochineal does not color so intensely as hæmatoxylin, and hence the latter often gives more satisfactory results in the case of large objects stained in toto.

As before pointed out, alcohol causes the salts contained in sea water to be precipitated, thus forming a crust on the exterior of the animal which interferes with the staining process. It is therefore necessary to treat marine animals that have been preserved in strong alcohol, with acid alcohol (1–10 parts hydrochloric acid to 1000 parts 70 per cent. alcohol), and then carefully wash in pure 70 per cent. alcohol before staining with cochineal.

*3. Picro-carmine.*—A very excellent picro-carmine is prepared by Dr. Mayer in the following manner:

To a mixture of powdered carmine (2 g.) with water (25 ccm.), while heating over a water bath, add sufficient ammonia to dissolve the carmine. The solution may then be left open for a few weeks (Mayer) in order that the ammonia may evaporate; or the evaporation may be accelerated by heating (Hoyer). So long as any ammonia remains, large bubbles will form while boiling, but as soon as the free ammonia has been expelled, the bubbles will

be small and the color of the fluid begin to be a little lighter. It is then allowed to cool, and filtered. To the filtered solution is added a concentrated aqueous solution of picric acid (about four volumes of the acid to one of the carmine solution).[1]

In order to protect this fluid against changes attributed to Bacteria by Hoyer,[2] Dr. Mayer places a small crystal of *thymol* in the containing bottle; Professor Hoyer uses *chloral-hydrate* (1 per cent. or more) for the same purpose.

*4. Acetic Acid Carmine.*[3]—Pulverized carmine added to a small quantity of boiling acetic acid (45 per cent.) until no more will dissolve; filtered and diluted to about 1 per cent. for use.

Flemming used the concentrated solution.

*5. Grenacher's Carmine Solutions.*[4]—(1) *Alum Carmine.*—An aqueous solution of alum (1–5 per cent., or any degree of concentration) boiled with ½–1 per cent. powdered carmine for 10–20 minutes; allowed to cool, then filtered.

With the addition of a little carbolic acid the fluid will keep for years. It colors quickly, and nuclei more strongly than other parts. Objects washed in water after staining.

(2) *Acid Borax Carmine.—a.* An aqueous solution of *borax* (1–2 per cent.) and *carmine* (½–¾ per cent.) heated till the carmine is dissolved.

*b. Acetic acid* added by drops to solution *a*, while shaking, until the color is about the same as that of Beale's carmine.

*c.* Solution *b* left standing twenty-four hours, then turned off and filtered.

This solution, which is a modification of Schweigger-Seidel's acid carmine, is not recommended for coloring in toto. It colors sections in ½–3 minutes diffusely, and hence, after washing in water, they are placed for a few minutes in alcohol (50 or 70 per cent.) to which a drop of hydrochloric acid has been added; then transferred to pure alcohol.

[1] The addition of the acid should cease before a precipitate begins to form.

[2] Hoyer. "Beiträge z. histolog. Technik." In Biolog. Centralblatt, B. II, p. 17–19.

[3] Schneider. Zool. Anzeiger, No. 56, p. 254, 1880.

[4] Grenacher. "Einige Notizen z. Tinctionstechnik." Arch. f. Mik. Anat., Vol. XVI, p. 463, 1879.

None of these solutions to be used where calcareous parts are to be preserved.

(3) *Borax Carmine.*[1]—*a.* An aqueous solution of *borax* (4 per cent.) and *carmine*, heated till the carmine is dissolved.

*b.* Solution *a* mixed with 70 per cent. alcohol in equal parts, left standing twenty-four hours and filtered.

This fluid may be used for coloring objects in tóto. After staining, the objects are to be washed in 35 per cent. alcohol, to which a little hydrochloric acid has been added (4–6 drops to 100 ccm.), and allowed to remain here until the color has been sufficiently removed. They are next passed through successively higher grades of alcohol for hardening.

(4) *Alcohol Carmine.*—A teaspoonful of carmine dissolved, by heating about ten minutes, in 50 ccm. of 60–80 per cent. alcohol, to which 3–4 drops of hydrochloric acid have been added, then filtered.

Objects colored in this fluid should not be washed in water, but in alcohol of a grade corresponding to that of the solution.

For diluting alcoholic solutions of carmine, alcohol of the same strength must always be used.

*6. Aniline Dyes.*—As a rule, aniline colors and the many others obtained recently from tar by chemical processes, can not be used for staining objects in toto, and are therefore not much employed in the Zoölogical Station. In very small objects and sections already cut, very excellent results can be obtained by the methods developed by Böttcher,[2] Hermann,[3] Flemming[4] and others; for here diffuse staining may generally be avoided by first overstaining and then withdrawing the color to any desired extent by means of alcohol. But to obtain satisfactory results, the sections must be thin enough to allow uniformity of action both to the coloring and the decoloring agent. It is evident that the process cannot be similarly controlled in larger objects, particularly where a dye is used, which, like most of those under consideration, is quickly extracted by alcohol, for in this case the color would be removed from the superficial layers more rapidly than from the deeper

[1] Dr. Mayer prepares, for some purposes, borax carmine of 50, 60 or 70 per cent. That of 70 per cent. contains little carmine, but is well adapted to staining delicate objects that would suffer if exposed to weaker solutions. Boiling alcohol (50 per cent. or 60 per cent.) dissolves about 1 per cent carmine and 1 per cent. borax.

[2] Bottcher. *Mul. Archiv.*, 1869, p. 373. Virchow's Archiv., Bd. XL, p. 302.

[3] Hermann. Communicated to the Naturforscherversammlung in Graz, 1875. Tagblatt, p.105,

[4] Flemming. Archiv. f. Mikr. Anat., Bd. XIII, p. 702, Bd. XVI, p. 302, Bd. XVIII, p. 151, Bd. XIX, p. 317, and p. 742, B. XX, p. 1.

ones, so that a uniform precision of color would be impossible. In this respect,

*a. Bismarck-brown* forms an exception. The preparation of this dye, introduced by Weigert,[1] is extremely simple:

A saturated solution is made by dissolving the powder in boiling water or weak alcohol, or, according to Mayer, in 70 per cent. alcohol.[2] The solution should be used undiluted, and requires to be filtered from time to time. It colors very quickly objects hardened in alcohol or chromic acid.

*b. Safranin.*—1 part *safranin* dissolved in 100 parts of *absolute alcohol;* after a few days 200 parts of *distilled water* is added.

Dr. Pfitzner,[3] from whom the above formula is taken, recommends this solution as one of the best for staining nuclei. It is cheap, easily prepared, acts quickly and stains *only* the nuclei. It works best with chromic acid preparations, from which the acid has been removed as much as possible.

7. *Flemming's methods of treating Nuclei.*—The method employed by Böttcher and Hermann of *over staining* objects with aniline dyes, and then removing the color to any desired extent by the aid of alcohol, formed the starting point of the methods recently published by Flemming. The following is a summary of the more important conclusions reached by Flemming:[4]

*A. For Nuclei in general.*—1. Objects hardened in *chromic acid* (1-10 per cent. to ½ per cent.).

The time will vary according to the nature of the object.

2. Carefully washed in distilled water.

3. Stained directly, or further hardened in weak and then strong alcohol.

*Safranin*, *Magdala red* (rose de naphthaline) and *dahlia* (monophenylrosanilin) give the best staining. Safranin prepared as given above; magdala in the same way; dahlia best dissolved in water, or acetic acid.

Only very small objects, or thin sections, can be successfully stained, and these should be left in the fluid 12–24 hours.

4. Objects transferred to weak alcohol (70 per cent.) and shaken for a few moments; then placed in absolute alcohol for half a minute or longer—till no visible clouds of color appear. The process of decoloring is now completed and the objects must be

[1] Wiegert. Arch. f. Mik. Anat., Bd. XV, p. 258, 1878.

[2] According to Flemming, may also be dissolved in dilute acetic acid.

[3] Pfitzner. Morph. Jahrb., VI, pp. 478–80 and VII, p. 291.

[4] Flemming. Archiv. f. Mik. Anat., Vol. XIX, p. 321.

at once removed from the alcohol, otherwise the color will be too much weakened. If it be required to examine the objects before mounting, they may be removed to distilled water, in which the color of the nuclei will remain unchanged for a considerable time. They must then pass through alcohol again before mounting.

5. Clarified in clove oil and mounted in *dammar-lac.*[1]

Clove oil withdraws the color a little, and hence it must not be allowed to work too long. Creosote extracts the color still more rapidly than clove oil.

*B. Eggs of Echinoderms.*[2]—In his recent researches on karyokinesis, Flemming states (p. 5) that he obtained serviceable staining of nuclei in the following ways:

1. *Living eggs colored on the slide,* either with *safranin* or *aniline dyes,* followed by acetic acid (1 per cent.) which is allowed to flow under the cover and thus replace the staining medium, or with

*Acetic acid carmine* (after Schneider), used undiluted. The last mentioned staining agent causes swelling, but still gives the typical features of the karyokinetic figures.

2. Eggs first hardened in strong nitric acid (40–50 to aq. dest. 60–50), then washed in distilled water until the yellowish color, due to the presence of the acid, disappears. Colored with acetic acid carmine.

### III. Methods of Dissecting.

For the dissection of single organs, fresh animals are generally placed in dilute alcohol, or a weak chromic solution. But the tissues are liable to suffer from maceration in these fluids, and hence, where it is important that the tissues should be well preserved, it is advisable to use picro-sulphuric acid, regardless of the injurious effects of the same on the dissecting instruments. The hardening capacity of the picro-sulphuric acid is extremely slight, but may be strengthened by the addition of chromic acid. Preparations thus obtained, and subsequently treated with alcohol, staining fluids, &c., should be transferred to creosote for further dissection, as the transparency induced by this medium will greatly facilitate the work.

### IV. Imbedding.

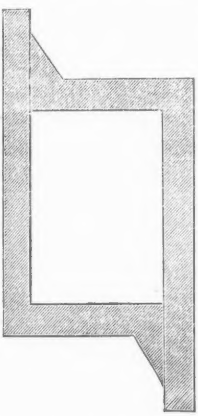
For section cutting, objects are usually imbedded in paraffine. By low temperature, as in winter, it is necessary to work with a softer paraffine than is required for summer. Instead of soften-

[1] Probably balsam dissolved in chloroform would answer the same purpose.

[2] Flemming. "Beitrage zur Kenntniss der Zelle und ihrer Lebenserscheinungen." Arch. Mik. Anat., Vol. XX, p. 1, 1881.

ing by an admixture of lard, as generally done, it is better to use a paraffine which becomes soft in summer, on account of its containing liquid hydrocarbons.

Preparatory to imbedding, the objects are removed from absolute alcohol[1] to creosote, clove oil or chloroform, and left until they become thoroughly saturated. The penetration of the clarifying fluid may, in some cases, be advantageously hastened by warming a little. They are next placed in soft paraffine, heated to about 50° C. over a water bath, and allowed to remain for an hour or so. The soft paraffine is then turned off and replaced by a mixture of hard and soft paraffine,[2] heated to about 50° C. After remaining for half an hour or less in the harder paraffine, kept at a steady temperature, they are ready for imbedding. For this purpose a small paper box may be used; or, much better, a box made of two pieces of type-metal, as used in Professor



Leuckart's laboratory. As will be seen from the accompanying diagram, each piece of metal has the form of a carpenter's square, with the end of the shorter arm triangularly enlarged outward. A convenient size will be found in pieces measuring 7 (long arm) by $3^{cm}$ (short arm), and $7^{mm}$ high. With such pieces a box may be constructed at any moment by simply placing them together on a round plate of glass, which has previously been wet with glycerine and gently warmed. The area of the box will evidently vary according to the position given to the pieces, but the height can be varied only by using different sets of pieces. In such a box the paraffine may be kept in a liquid state by warming now and then over a spirit lamp, and small objects be placed in any desired position under the microscope.

It is well to imbed in a thin layer of paraffine, so that the object, after cooling, may be cut out in small cubical blocks, which

[1] In many cases a lower grade of alcohol will suffice.

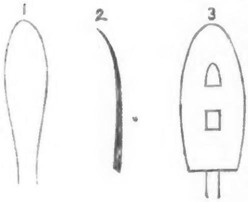
[2] The ratio of combination must be determined by experiment, since it will depend on the quality of the paraffine and the temperature. Two parts of hard to one of soft, work very well for the winter temperature of Naples.

may be easily fixed, for cutting, to a larger block of hard paraffine.

### V. CUTTING.

Objects are cut dry with a microtome,[1] and the rolling of the sections may be prevented by holding a thin narrow spatula over the edge of the knife while cutting. The spatula may be made of brass, in the form of Fig. 1; of paper fastened to a flattened needle as indicated in Fig. 3. The spatula should be bent slightly (Fig. 2), and its convex face held over the paraffine without pressure. A small brush, slightly flattened, is used for the same purpose in Leipsic.

1 2 3



### VI. GIESBRECHT'S METHODS.

(1) *Transferring from Alcohol to a solvent of Paraffine.*[2]—To avoid shrinkage in transferring tender objects from alcohol to chloroform or an oil, pour a little absolute alcohol into a small glass tube, place the canular end of a pipette containing the solvent below the surface of the alcohol, and allow a few drops to flow from it to the bottom of the tube; into this tube let fall, by the aid of another pipette, or a small spatula, a few drops of absolute alcohol containing the objects to be imbedded. The objects will sink through the alcohol, which, being the lighter fluid, has taken a superjacent position, and rest on the upper surface of the fluid expelled from the first pipette. Most of the alcohol may now be removed by a pipette, and the objects left to sink gradually into the heavier fluid at the bottom of the tube. In this way the replacement of the alcohol contained in the objects by an oil, or some solvent of paraffine, is much retarded, and thus the danger from shrinkage reduced to a minimum.

Where chloroform is preferred to creosote or oil of cloves, a little ether (æther sulfuricus $C_4H_6O$) should be added, as many objects will not sink in pure chloroform.

To replace alcohol by a solvent of paraffine, and then by par-

[1] An improved form of Thoma's microtome is made by Rudolph Yung, Heidelberg, Hauptstrasse 15. The carrier is moved by a micrometer screw, and the holder can be adjusted in any desired position. A full description of the instrument with all the recent improvements will soon be given by Dr. Mayer.

[2] Giesbrecht. "Zur Schneide-Technik," in Zoolog. Anzeiger, 1881, No. 92.

affine itself, is an operation which may, in many cases, be readily accomplished by employing any one of the ordinary intermedia, such as oil of cloves, bergamot oil, creosote, turpentine, chloroform, &c. But with tender objects, particularly those with larger or smaller internal cavities, the process is often attended with great difficulties, and in such cases collapse and shriveling can only be avoided by giving the most careful attention to every step in the process.

Dr. Giesbrecht recommends, for difficult cases, chloroform,[1] as it is one of the best, and at the same time the most volatile solvent of paraffine.

(2) *Transferring from Chloroform to Paraffine.* — After the objects have become thoroughly saturated with chloroform, the containing tube is placed on a water bath and heated to about 50° C.—the melting point of paraffine; then a small piece of paraffine is added and allowed to dissolve, and this is repeated until bubbles cease to rise from the objects. To make sure that the chloroform has been fully expelled, the objects may next be transferred to pure paraffine and left for a few minutes before imbedding.[2]

(3) *Shellac as an aid in Mounting.*—The use of *shellac* for fixing sections on the slide, introduced by Dr. Giesbrecht,[3] is a very valuable addition to histological methods. By this method hundreds of small sections may be arranged in serial order, and all inclosed in balsam under the same cover without danger of disarrangement. The method is further extremely useful in mounting larger sections, particularly those composed of loose parts, or parts liable to swim apart.

[1] Bütschli (Biolog. Centralblatt, B. I, p. 591) has also recommended chloroform, entirely overlooking, as it would seem, Dr. Giesbrecht's prior publication.

[2] For the Hydrozoa, Professor Weismann prefers turpentine to chloroform, as where the latter has been used, the paraffine is liable to be more or less spongy in consequence of bubbles lodged in the tissues.

Turpentine renders objects brittle, and on this account chloroform will, in many cases give better results. The spongy state of the paraffine results from the fact that the chloroform has not been allowed to wholly escape.

In the case of the Actiniæ, Dr. Andres employs a mixture of turpentine, creosote and alcohol, using successively mixtures containing more turpentine and less alcohol, thus:

| | Mixture No. 1. | No. 2. | No. 3. | No. 4. |
|---|---|---|---|---|
| Turpentine | 1 | 2½ | 4½ | 7½ parts. |
| Creosote | 2 | 2½ | 2½ | 2½ " |
| Alcohol (absolute) | 7 | 5 | 3 | 0 " |

[3] Giesbrecht. "Methode zur Anfertigung von Serien-Praparaten," in Mittheilungen a. d. Zoolog. Station zu Neapel, 1881, p. 184.

The shellac is prepared and used in the following manner: One part of bleached shellac[1] mixed with ten parts absolute alcohol, and filtered. The object glass is first warmed to about 50° C.,[2] and then a thin film of the shellac is laid on by a glass rod drawn once over its surface. Before using, the slide is again warmed, and the shellac surface washed with oil of cloves for the purpose of softening it. The wash is made with a small brush drawn back and forth until the entire surface has been moderately but evenly wet with the oil. Sections are now cut and arranged for the first cover; this done, the slide is warmed over a spirit lamp so that the paraffine adhering to the sections melts and flows together, forming an even layer which cools almost instantly, and thus secures the position of the sections while those of the second cover are prepared. The sections for the last cover having been completed, the slide is warmed for ten minutes on a water bath, in order that the sections may sink into the shellac and become fixed, and the clove oil evaporate. After allowing the slide to cool the process is concluded by washing away the paraffine with turpentine, and inclosing in balsam dissolved in chloroform.[3]

[1] Dr. Mark informs me that he uses "the bleached shellac in the form in which it is prepared for artists as a '*fixative*' for charcoal pictures. It is perfectly transparent, and a film of it cannot be detected unless the surface is scratched." Dr. Mark attaches a small label to the corner of the slide, which serves for the number of the slide and the order of the sections, and at the same time marks the shellac side (otherwise not distinguishable).

[2] The same temperature is used throughout the operation.

[3] Since the above was written, my attention has been called to the following mode of fixing sections, first described by Dr. Gaule (Archiv. f. Anat. u. Phys., 1881, Phys. Abthlg., p. 156):

1. Sections cut dry and placed on the slide in the order and position in which they are to be mounted.

2. They are then smoothed out by the aid of a fine brush wet in 50–60 per cent. alcohol, until all wrinkles are removed and every part is in close contact with the slide.

3. Slide allowed to stand several hours (or over night) until the alcohol has completely evaporated, and the sections are left adhering quite firmly to the glass. The process may be hastened by gently warming to 45–50° C.

4. The paraffine may be removed by any of the solvents in common use, but Dr. Gaule recommends Xylol. A few drops are allowed to flow over the sections, and after a few moments the paraffine is fully dissolved.

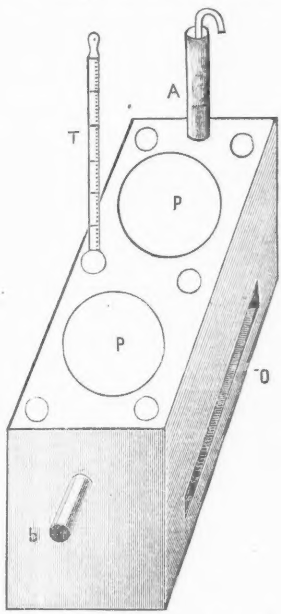
5. The balsam (a mixture of balsam and xylol in equal parts) is placed on the cover-glass, and this allowed to sink slowly, from one side, over the sections.

Dr. Gaule finds it convenient, especially with serial sections, to use large cover-glasses—often nearly as large as the slide itself. Thus a single slide may often contain a large number of sections closely arranged under one cover.

For large sections this method offers one important advantage over that of Dr. Giesbrecht; for by the former all wrinkles may be removed, while by the latter the sections must lie as they fall. In the case of smaller sections, not liable to get wrinkled during the placing, I prefer the shellac method.

### WATER BATH.

The diagram represents a convenient form of water bath, devised by Dr. Mayer.




It is a small brass box $18^{cm}$ long, $9^{cm}$ wide and $8^{cm}$ high. The tube *a*, through which the water is received, and the rod *b* serve as handles. The receiving tube is closed by a cork provided with a glass tube for the escape of steam, which is bent in the form of a siphon to protect against dust. One and a-half centimeters from the base of the box is an oven (*o*) $.7^{cm}$ high, and $12^{cm}$ long, which passes completely through the box, and serves for warming the slides when shellac is used. Above are seen two circular basin-like pits (*p*) $5.5^{cm}$ in diam., and $4^{cm}$ deep, for receiving the two tin paraffine holders. These are covered by circular plates of glass. There are also six tubular pits, one for a thermometer (*t*), the others for glass tubes.

This water bath will be found useful for other purposes than those of imbedding and mounting. It will of course be understood that the purpose in giving its exact dimensions is simply to furnish a guide where one is required. There are at least two important advantages offered by this water bath over those in general use, viz., the slides are protected from dust, and the paraffine is not exposed to the water.

——:o:——

## ON THE HOMOLOGIES OF THE CRUSTACEAN LIMB.

BY A. S. PACKARD, JR.

THE following observations are reprinted from an essay on North American Phyllopod Crustacea, contributed to the forthcoming Twelfth Annual Report of the U. S. Geological and Geographical Survey of the Territories, F. V. Hayden in charge. I am indebted to Dr. Hayden's kindness for the use of the illus-

trations—Messrs. Sinclair & Son having, at their own expense, kindly struck off an edition of the accompanying plates from the drawings on stone made by them for the Survey.

The reader is supposed to have a general knowledge of Crustacea, especially the Phyllopods, a brief account of which may be found in the author's Zoölogy, where the genera here referred to are figured. As to the anatomy of these interesting Crusta-

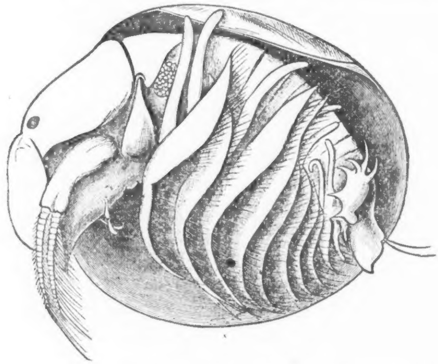


FIG. 1.—*Limnetis brevifrons*, enlarged. Burgess, del.

cea, a transverse section of the anterior part of the body of any genus of Phyllopods (see Pl. XII, Fig. 2, also Fig. 1 in text) will convey an excellent idea of the leading features in their organization, especially those by which they differ from the members of other Crustacean orders. The leading topographical features in the body, particularly of Arthropods, are the form of the elemental segments with their appendages, and the relations of the principal anatomical systems to the body-walls.

*General relations of the systems of organs to the body-walls.*—We will first look at a section of a typical Phyllopod, such as *Apus* (Fig. 2). The body-walls are rather thick and the muscles are well developed, particularly the dorsal extensor muscles, and the motor or extensor muscles of the limbs, which arise in part from the dorsal region, and in part from the sides and sternal region. The body cavity is rather small. The heart is large, either cylindrical as in Estheria, or flattened as in *Thamnocephalus*. The digestive tract is large, capacious, and the cavity of the head is mainly filled with the two liver masses; the brain being remarkably small, while the nervous cord, especially the second and succeeding ganglia, are remarkably small and weak, compared with other

Crustacea, either the malacostracous or the entomostracous orders; this peculiarity is well brought out in the transverse sections, where the diminutive size of the thoracic ganglia, particularly in *Limnetis* and *Estheria* is noteworthy. The apparent bulk of the body is largely due to the large size and nature of the leaf-like or foliaceous appendages, with their broad attachments; the latter peculiarity is characteristic of the Branchiopods in general and the Phyllopods especially, and is quite different from the definite, small coxal articulations of the legs of Malacostraca or Copepoda. The ovaries or testes, according to the sex, form a large lobulated mass extending along each side of the digestive canal, as far forward as the base of the head. Their relations in *Apus* are seen in Plate XXII, Fig. 2, and in *Thamnocephalus* in Plate XIV, Fig. 4 of our essay.

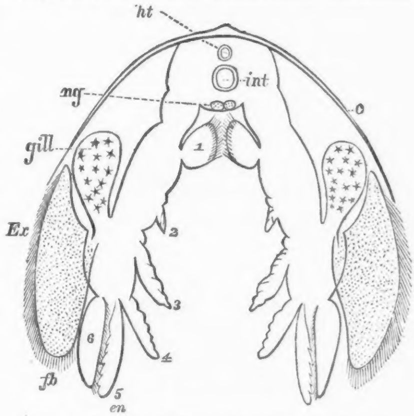



FIG. 2.—Section of Apus; *ht*, heart; *int*, intestine; *ng*, ganglion; *c*, carapace; 1–6, the six exites, 1 being the gnathobase; *gill* and *fb*, flagellum, representing the exites.

*The segments of the body.*—Phyllopoda are exceptional to other Crustacea in having an indefinite number of segments composing the body, and in having in one family (*Apodidæ*) more than one pair of appendages to an arthromere. While the normal number in the Decapoda is twenty-one, in the Phyllopods it varies from seventeen in Limnetis to forty-seven in Apus. The following table shows the number in different genera of American species:

| | Antennal segments. | Mandibles. | Maxillæ. | Maxillipedes. | Limb segments. | Abdominal segments. | Telson. | Total. |
|---|---|---|---|---|---|---|---|---|
| Limnetis | 2 | I | I | .... | 12 (–14) | 0 | I | 17–19 |
| Estheria | 2 | I | 2 | .... | 23–27 | 0 | I | 29–33 |
| Limnadia | 2 | I | 2 | .... | I 22 | 0 | I | 28 |
| Apus | *2 | I | I | †I | 27 (60 pairs limbs) | 32 (14) | I | 47 |
| Artemia | 3 | I | 2 | 0 | 11 | 8 | I | 25 |
| Branchinecta | 2 | I | 2 | 0 | 11 | 9 | I | 26 |
| Branchipus | 2 | I | 2 | 0 | 11 | 9 | I | 26 |

* Second antennæ sometimes wanting.
† The endite of *Apus* wanting in the American species.

In an *Apus lucasanus* forty-two millimeters in length there are sixty pairs of legs behind the maxillipedes. There are forty-two segments behind the maxillipedal segment, including the telson, and twenty-seven limb-bearing segments, or sixty pairs of legs to twenty-seven segments, the average being two and six-twenty-sevenths ($2\frac{6}{27}$) appendages to each leg-bearing segment. On the first eleven leg-bearing arthromeres, or the ten thoracic legs (bænomeres) together with the first abdominal arthromere, there is but a single pair of appendages to a segment, so that there are forty-nine pairs of abdominal appendages to sixteen arthromeres, or three and one-sixteenth pair of limbs, on the average, to each abdominal arthromere. The fourteenth, fifteenth and sixteenth pairs are situated on two arthomeres, and so on with the succeeding until the limbs become more numerous. On the two arthromeres before the last leg-bearing one, there are twelve pairs of appendages, or six to each arthromere.

This irrelative repetition of arthromeres is only paralleled in one other Branchiate group, the *Trilobita.* In this group the new segments are interpolated between the head and abdomen at successive molts, as shown by Barrande.

The grouping of the body segments into a cephalothorax and abdomen, comparable with those two regions in the Decapoda is but slightly, if at all, indicated in the Phyllopoda. In *Limnetis* there is no such distinction of regions, in Apus the cephalothorax merges insensibly into the abdomen, and it is not until we ascend to the *Branchiopodidæ* that we meet with a well-marked abdomen separated by tolerably clear indications from the thorax.

*The Appendages in general.*—The appendages of Crustacea may be divided into four groups: First, the sensory appendages, or antennæ, which are in the adult preoral; second, the organs of prehension of food and of mastication, *i. e.*, the mandibles and accessory jaws, or maxillæ and maxillipeds, which are postoral; third, organs of locomotion, whether natatorial or ambulatory, which are appended to the thoracic portion of the body; and fourth, the appendages of the abdomen, which are both natatorial and concerned in reproduction; of the latter are the two pairs of gonopoda[1] in the Decapoda, while the eleventh pair of appendages in Apus may perhaps be regarded as gonopods.

[1] I have (AMERICAN NATURALIST, XV, p. 881, 1881) applied the term *gonopoda* (Gr. γονή, generation; πούς, ποδος, foot) to the first and second abdominal limbs

The following table will give our idea as to the succession and nomenclature of the appendages in the three subclasses of Tracheata and the two subclasses of Branchiate Arthropods:

TABLE A.

| Number of segments. | Hexapoda. | Arachnida. | Myriopoda. | Crustacea (neocarida decapoda). | Merostomata. (Limulus.) |
|---|---|---|---|---|---|
| 1 | Antennæ. . . . . . | Mandible . . . . . | Antennæ . . . . . | First antennæ . . | First (preoral) leg. |
| 2 | Mandibles . . . . . | Maxilla (chela). . | "Maxilla". . . . | Second antennæ . | Second (postoral) leg. |
| 3 | First maxillæ . . . | First leg . . . . . | "Mandible" . . . | Mandibles . . . . | Third pair legs. |
| 4 | Second maxillæ (labium.) | Second leg . . . . | "Labium" . . . | First maxillæ . . | Fourth pair legs. |
| 5 | First thoracic legs (bænopods). | Third leg. . . . . | First pair of legs . | Second maxillæ . | Fifth pair legs. |
| 6 | Second thoracic legs (bænopods). | Fourth leg . . . . | Second pair of legs | First maxillipedes | Sixth pair legs. |
| 7 | Third thoracic legs (bænopods). | Embryonic, deciduous. | Third pair of legs | Second maxillipedes. | First abdominal legs. |
| 8 | First embryonic deciduous legs.* | . . do . . . . . . | Fourth pair of legs | Third maxillipedes | Second abdominal legs. |
| 9 | Second embryonic deciduous legs. | . . do . . . . . . | Fifth pair of legs . | First pair of legs. (bænopods). | Third abdominal legs. |
| 10 | Third embryonic deciduous legs. | . . do . . . . . . | Sixth pair of legs | Second pair of legs (bænopods). | Fourth abdominal legs. |
| 11 | Fourth embryonic deciduous legs. | First pair spinnerets. | Seventh pair of legs. | Third pair of legs (bænopods). | Fifth abdominal legs. |
| 12 | Fifth embryonic deciduous legs. | Second pair spinnerets. | Eighth pair of legs | Fourth pair of legs (bænopods). | Sixth pair abdominal legs. |
| 13 | Sixth embryonic deciduous legs. | Third pair spinnerets. | Ninth pair of legs. | Fifth pair of legs (bænopods). | |
| 14 | First pair of rhabdites.† | Telson of scorpion. | Tenth pair of legs. | First abdominal legs (uropods). | |
| 15 | Second pair of rhabdites. | . . . . . . . . . . | Eleventh pair of legs. | Second abdominal legs (uropods). | Telson (spine). |
| 16 | Third pair of rhabdites. | . . . . . . . . . . | Twelfth pair of legs. | Third abdominal legs (uropods). | |
| 17 | Cercopoda of some Orthoptera and Neuroptera, and anal legs of caterpillars. | . . . . . . . . . . | Thirteenth pair of legs. | Fourth abdominal legs (uropods). | |
| 18 | Eleventh abdominal segment in some Orthoptera and Pseudo-neuroptera. | . . . . . . . . . . | Fourteenth . . . . | Fifth abdominal legs (uropods). | |
| 19 | . . . . . . . . . | . . . . . . . . . . | Fifteenth. . . . . | Sixth abdominal legs (uropods). | |
| 20 | . . . . . . . . . | . . . . . . . . . . | Sixteenth; 200th in Geophilus.‡ | Telson . . . . . . | |

* See Kowalevsky, Embry, Studien an Wurmern und Arthropoden, 1871, Plate XII, Fig 10. Embryo of *Sphinx populi*, in which the first ten abdominal segments have temporary rudimentary appendages, some of which persist in the caterpillar, serving as prop.legs.

† The ovipositor of insects, as we originally pointed out in 1868 (Proc. Boston Soc. Nat. Hist., XI, 393), is primarily composed of three pairs of appendages (called by Lacaze-Duthiers "rhabdites"), which arise in the same way as the legs; this view has been confirmed by Ganin, Kraepelin and Dewitz.

‡ The number of movable segments in the Geophilidæ, according to Newport, varies from about 35 to more than 200.

of the Decapoda, which are, as is well known, modified into accessory generative organs. The term is suggested as a convenient one to use in descriptive carcinology when speaking of either or both pairs of the basal abdominal limbs of the male Decapod. In the female they are not modified.

*Camparison wth limbs of Cladocera.*—We should naturally first compare the appendages of the Phyllopods with the members of their own order, and especially the *Cladocera;* and here, whether we consider the carapace-valves, the eyes single and compound, the two pairs of antennæ, or the telson, we find a very close connection in form between *Limnetis* and *Daphnia* or *Moina.* In the accompanying sketch (Fig. 3) from Gruber and Weismann's excellent paper on the Daphnidæ[1] (which we have slightly modified,

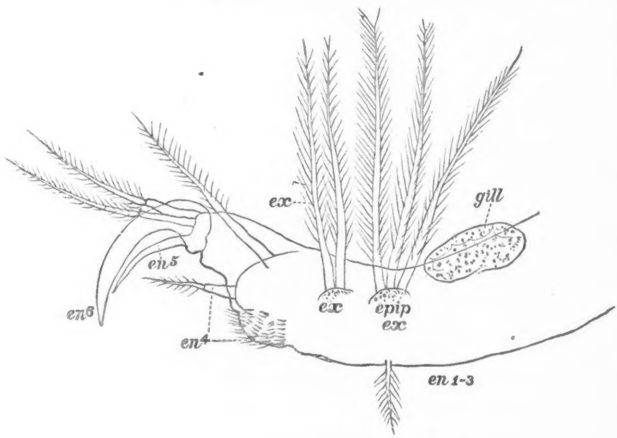



FIG. 3.—First leg of male of Moina (for comparison with that of male Limnetis): *ex*, exite; *epip*, epipodal portion of limb; *en*⁴–*en*⁶, endites, 4–6 compare with the endites forming the hand of the male Limnetis. The base of the endopodal region (*en* 1–3) not differentiated as in the Phyllopod limb.

introducing dots in the branchial portion) may be seen how nearly the first leg of the male of *Moina rectirostris* agrees with that of the male *Limnetis*, as seen in the sixth endite forming a claw like that of *Limnetis*, although the flabellum is not clearly differentiated from the endopodal portion of the limb. But when we look at the third pair of limbs of the female of the same Cladoceran (Fig. 4), we find an epipodal portion (flabellum, *ex*, and gill) differentiated from the endopodal portion of the limbs. The endopodal portion in the *Cladocera* is not differentiated, and forms a number of well-marked lobes or endites (Lankester), as in the Phyllopoda; this differentiation into six endopodal lobes being peculiar to the *Phyllopoda.*

The Cladocerous limb is intermediate in form and complication

[1] Ueber einiger neue oder unvollkommen gekannte Daphniden. 1877.

between the Phyllopodous and Ostracodous limbs, and the latter are evidently derived from the Copepods, so that there is a continuous ascending series from the Copepoda through the Ostracoda to the Cladocera, and thence to the Phyllopoda. Hence, as the young of the Copepoda are all Nauplii, and also those of the Phyllopoda, it follows that the ancestral form of all the Entomostracous Crustacea, as originally insisted on by Fritz Müller (Für Darwin) was a nauplius-like animal.

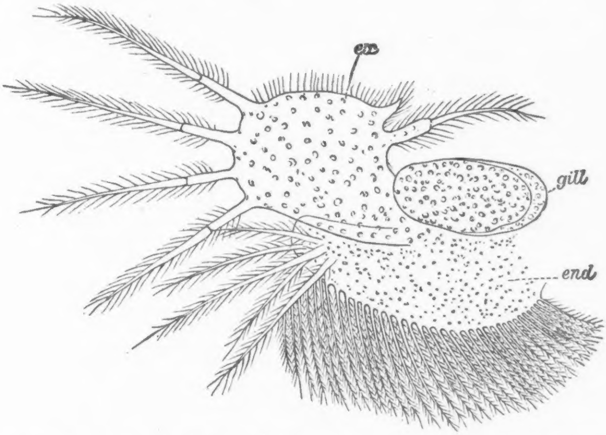



FIG. 4.—One of the third pair of limbs of Moina: *end*, the endopodal portion; *ex*, the exopodal (epipodal) portion of the limb.

*Comparison with the Decapodous limbs.*—Having studied the homologies of the Phyllopodous limbs among themselves, and also compared them with those of the Cladocera and Ostracoda, it remains now to compare the thoracic appendages of the Phyllopods with those of the adult *Decapoda.* At the outset, however, it seems nearly impossible to compare the swimming legs of the Phyllopods with the abdominal and thoracic appendages of Decapods. The thoracic Decapodous legs are axially jointed, consisting of an axis or protopodite, which is wanting in the Phyllopoda and all lower Crustacea, with no endital lobes as in Phyllopods, though the gill and flabellum of the Phyllopods are homologous with the gills and flabellum of the Decapod. There is no such relation or close resemblance as to lead us to infer that as regards the nature of the thoracic and abdominal feet the Decapods have descended from the Phyllopods. The Decapods have probably

come down to us by a different branch of the Crustacean ancestral tree, and have arisen entirely independently of the Phyllopodous branch, by a line leading back directly to the ancestral Nauplius, the common ancestor of all the *Neocarida.*

Nor does it seem to us that this statement or hypothesis is weakened when we consider the resemblances between the thoracic feet of the Phyllopods and the maxillæ and maxillipedes of the Decapoda. When we compare the leg of a Phyllopod with the second maxilla[1] of the lobster (Fig. 6, B) or crayfish, we can detect a close homology, the chief difference being in the fact that the lobes of the endopodite are less numerous in the Decapod than in the Phyllopod. This close resemblance is based on the fact, which appears to have been overlooked by Claus and Lankester, *i. e.*, that as in the Phyllopodous limb, the maxillæ of the Decapods have no jointed axis, the limb consisting of epipodal and endopodal portions alone, the stem or axis being wanted. In the maxillipedes, where part of the endopodal region of the limbs becomes, as

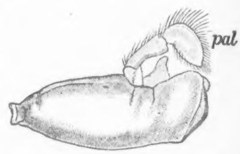



FIG. 5.—Mandible of the lobster, *Homarus americanus: pal*, palpus.

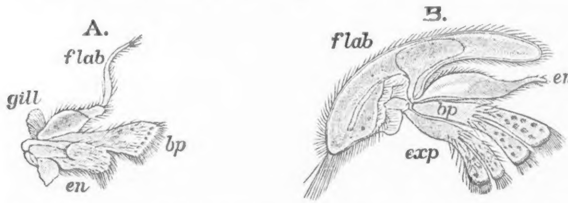



FIG. 6.—A, first maxilla of lobster; *en*, endopodite; *bp*, basipodite; *flab*, flabellum. B, second maxilla of lobster; *bp*, basipodite (epignathus); *cxp*, coxopodite. (This appendage, with its five endopodal lobes, approximates nearest to the Phyllopod limb.)

Lankester[2] claims, two multiarticulate endites, the fifth and sixth; or, as in the thoracic leg, becomes a single seven-jointed endite, the homologies cannot with certainty be traced. The lobster's thoracic leg consists of the jointed axis which is the homologue of perhaps the fifth endite of the Phyllopodous foot (Lankester),

[1] The resemblance to the second maxillæ of the young lobster in its first stage when freshly hatched, is still more striking. See Smith's Early stages of the American Lobster, Pl. XVI, Fig. 4.

[2] See his able article on the morphology or Apus, *Quart. Journ. Mic. Science*, 1881.

and the complicated gills and gill-fan (scaphognathite) correspond to the gill and flabellum of the Phyllopodous leg or flabellum.

In brief, the maxillæ of the Decapoda most closely resemble

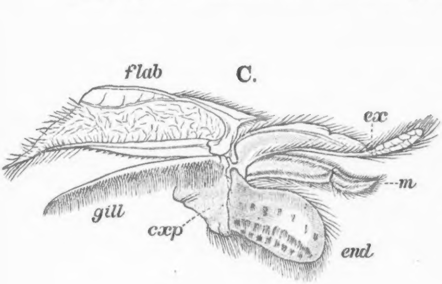



FIG. 7.—C, first maxillipede of lobster.

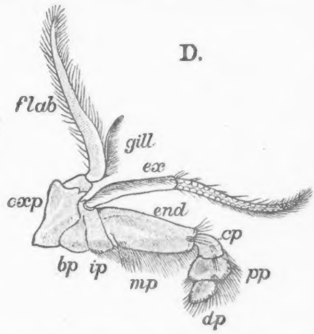



FIG. 8.—D, second maxillipede; *ex*, exopodite; *end*, endopodite; *flab*, epipodite or flabellum, or scaptogathnite.

the legs of Phyllopods. The maxillipedes, for example, those of the third pair, are much more differentiated than the limbs of the Phyllocarida or Phyllopoda. In the Decapoda the gill and flabellum are homologous with those of the groups just enumerated; while the endopodite and exopodite of the Decapoda represent

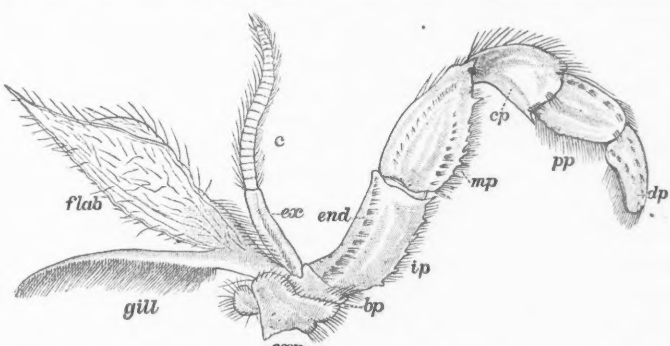



FIG. 9.—B, third maxillipede, *cxp*, coxopodite; *bp*, basipodite; *ip*, ischiopodite; *mp*, meropodite; *cp*, carpopodite; *pp*, propodite; *dp*, dactylopodite; *c*, multiarticulate extremity of exopodite or palpus; *flab*, epipodite.

the endopodal portion of the limb of the lower groups. There is in the Phyllopoda no division into a coxopodite and basipodite or stalk, from which two axially jointed divisions branch off,

homologous with the exopodite and endopodite of the Decapoda. In the latter the maxillipede is highly differentiated; in the thoracic limbs of the Phyllocarida and Merostomata it is uniaxial and jointed, but in the Phyllopoda not truly jointed. In the simplest Decapod limb, that of the abdomen, we have a stem succeeded by two divisions, the exopodite and endopodite; in the thoracic feet we have but one of these branches, the endopodite, while in the maxillipedes, the most differentiated, we again have a stem and two branches (endopodite and exopodite), together with the gill and flabellum. Thus the entire leg of the Phyllopod (without the gill and flabellum) is homologous with the endopodite of the Decapod maxillipede, and the gill and flabellum with those of the Decapoda.

*Comparison with the thoracic limbs of Nebalia* (Phyllocarida).—Not to enter into detail, by a glance at Plate X and the figures in Plate XIV, it will be seen that the thoracic appendages of *Nebalia* consist of an inner axial-jointed portion (the endopodite), which may perhaps be regarded as homologous with the endopodite of the Decapod maxillipede, and also with the thoracic legs of the lobster. This also corresponds to the endopodal unjointed portion of the Phyllopod thoracic limb. In the exopodal or respiratory portion (*ex*) the upper part corresponds to the Phyllopod gill, and the double lower portion to the flabellum.

*Comparison with the feet of Limulus* (Merostomata).—The resemblance between the abdominal legs of Limulus and the thoracic ones of Nebalia is apparent on inspection of Pl. X, figs. 3 and 4. In Limulus the shell flares out widely and the appendages are united in the middle, although separate in embryonic life, so that this is a feature of secondary importance. The point of special interest is, that the abdominal feet of Limulus may, as in the thoracic appendages of the *Phyllopoda* and of the *Phyllocarida*, or the maxillæ, maxillipedes, and thoracic feet of the Decapoda, be divided into an inner endopodal portion (whether ambulatory or natatory), and an outer or respiratory portion, as in *Nebalia* and Decapoda. The endopodite of Limulus (*en*) is axially-jointed, there being three well marked joints to this part of the limb. The branchiate portion of the limb (*ex*) is homologous with that of Nebalia, and the epipodital or branchiate portion of the Decapod thoracic limb. At the same time that of Limulus presents some remarkable peculiarities, *i. e.*, the exopodal (or epipodital)

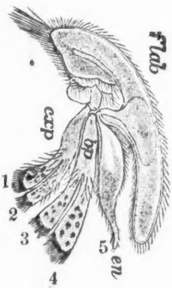



Fig. 1.

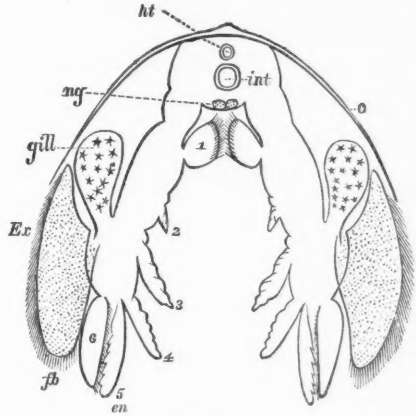



Fig. 2.

FIG. 1.—Maxilla of lobster with its five lobes (1–5) corresponding to the endites of the Phyllopod thoracic limb. FIG. 2.—Section through the thorax of Apus: *en*, 1–6, the six endites; *ex*, exopodal or respiratory portion of the limb; *c*, carapace.

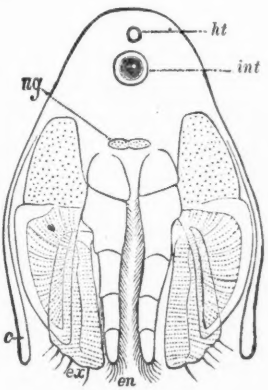



Fig. 3.

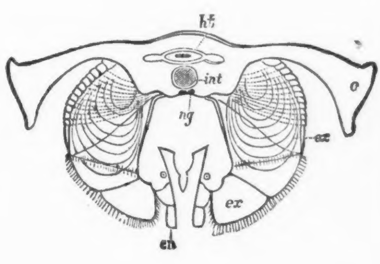



Fig. 4.

FIG. 3.—Partly diagrammatic section through the thorax of Nebalia; *en*, the axial-jointed endopodite; *ex*, exital portion or gill (above irregularly dotted) and flabellum below with rows of dots; *c*, carapace.

FIG. 13.—Actual section through the abdomen of Limulus: *c*, carapace; *ht*, heart; *int*, intestine; *ng*, ganglia (lettering being the same as Fig. 3); *en*, axial-jointed endopodite; *ex*, exital or respiratory portion bearing the gill-lamellæ; the outer division (*ex*) homologous with the exopodal portion of the Phyllopod and Phyllocaridan appendage.

HOMOLOGIES OF THE CRUSTACEAN LIMB.

portion is jointed; and the gill, instead of being a simple, fan-like extension, as in the Phyllopoda and Phyllocarida, is replaced by a number of flat, thin gill-plates, arranged parallel to each other, in an antero-posterior sense. When, however, we compare the gill, or rather the epipodital portion of the leg of Limulus, with that of the lobster, we have the various fundamental elements, *i. e.* an artery and a vein passing into the foot and in connection with a number of gill-plates. In the lobster we have along the base of the gill (Fig. 9), collective veins and an artery into which the blood passes after being aerated in a large number of cylindrical gill-filaments. Morphologically there is a fundamental resemblance between the two types of branchiæ; in Limulus there are gill-plates, in Decapods gill-filaments, each presenting in the aggregate a large respiratory surface. The gills of the Isopoda are in some degree intermediate between the Decapods and the Merostomata.

When we compare the anterior or cephalic appendages with the thoracic appendages of the lobster, there is a close resemblance in the axially-jointed endopodite (Fig. 10, *end*) of Limulus with its large terminal claw to the foot of the Decapod. The absence of the gill or branchiate (epipodital) portion in Limulus is correlated with the ambulatory nature of its anterior or cephalic appendages.

In the trilobites, however, as may be seen by Mr. Walcott's able restoration (Fig. 12), we have attached to the thoracic ambulatory feet a respiratory epipodital portion. In some respects, then, in the trilobites we have a style of structure intermediate between the Merostomata and the Decapoda.

In the trilobite we apparently have, besides a true-jointed locomotive endopodite (Fig. 12, *en*), an inner jointed appendage (*en'*), which may be homologized with the exopodite of the Decapod maxillipede (Fig. 9). From near its base arises the two singular spiral gills, which are unique. It is to be observed that the two jointed appendages and the stem of the gills arise from what appears to be a true coxopodite, and that this coxopodite is apparently homologous with that of Limulus (Fig. 10). It thus appears that a study of the general internal anatomy and of the appendages of the normal, recent Crustacea (*Neocarida*) throws light upon the structure of the archaic Crustacea (*Palæocarides*), and that the most archaic Neocarida, the Phyllocarida (Nebalia),

as regards their thoracic limbs, do not remotely resemble the abdominal limbs of Limulus. In this connection we would draw attention to Fig. 11, which is designed to show the possible relations between Limulus and Calymene, or the Merostomata and the Trilobita. The essential difference is in the nature of the

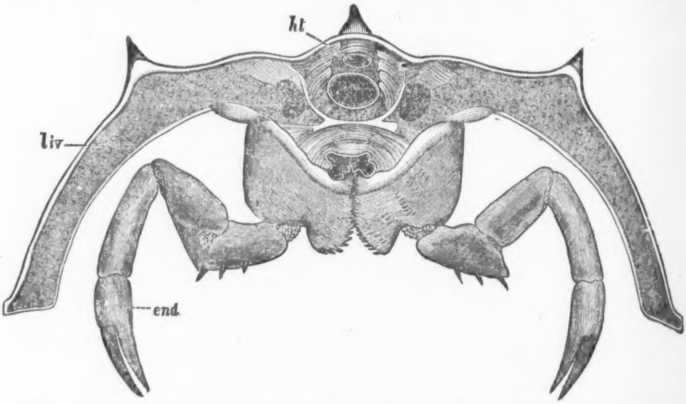



FIG. 10.—Actual section through the head of Limulus, showing the second pair of appendages and their relation to the shell or carapace: *ht*, heart; *liv*, liver; *end*, appendage homologous with the endopodite of Decapoda.

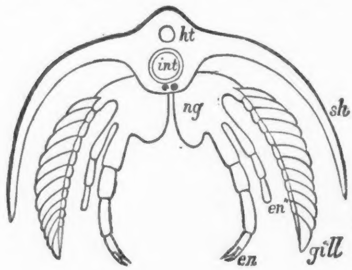



Fig. 11.

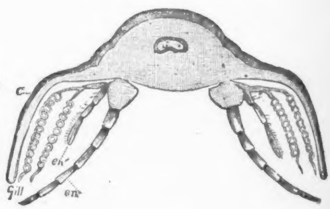
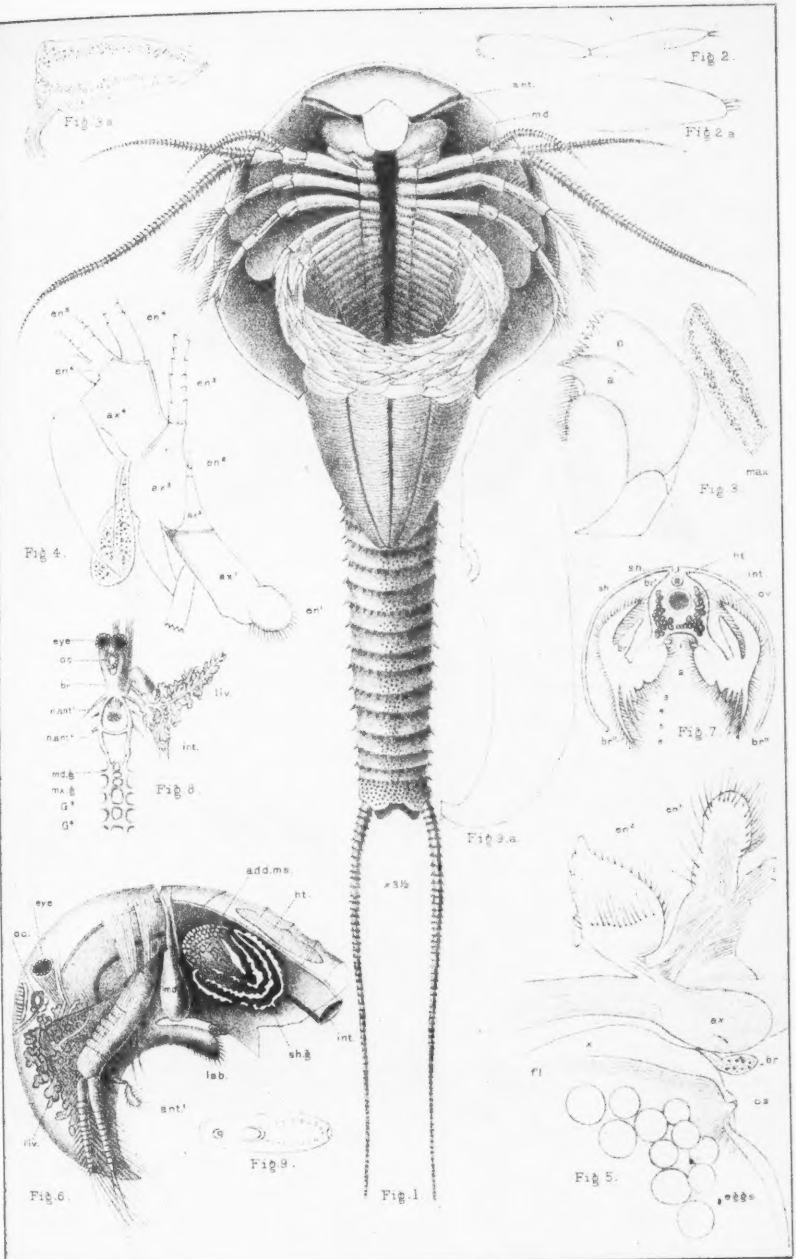



Fig. 12.

FIG. 11.—Diagrammatic section through body of a hypothetical form to show the possible homologies between the appendages of Limulus and a trilobite; the lettering as in Fig. 16.

Fig. 12.—Restored section of the thorax of a trilobite (Calymene), after Walcott: *c*, carapace; *en*, endopodite; *en'*, exopodite with the gills on the exopodal or respiratory part of the appendage.

limbs; the thoracic limbs of trilobite, while having a jointed endopodite as in Limulus, also having an exopodite and a forked spiral gill. Now, if we append to the coxopodite of Limulus an exopodite, and instead of having the gills arranged anteroposteriorly, like the leaves of a book, have them arranged on one side

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ANATOMY OF APUS.

(the outer) of a more or less cylindrical epipodite, as we have drawn them in Fig. 11, we shall hardly be doing greater violence to nature than we see to occur in any Decapod, where, as may be seen in Pl. x, the maxillæ of the lobster have no specialized exopodite, such as is so well marked in the maxillipedes, and the thoracic legs possess not even the rudiments. Change of function and radical changes of structure are most extreme in the Malacostracous Crustacea, from the Brachyura to the Isopoda and Amphipoda. If so startling in these comparatively recent forms, it is not to be wondered at that still greater and more fundamental modifications of the Crustacean type obtain in the archaic forms, the Palæocarides, of which Limulus is the sole survivor. To those who insist on the Arachnidan affinities of the Merostomata, we would suggest that the same shifting and change of function and structure is to be observed among the Tracheate Arthropoda, and that Limulus is not less a genuine Branchiate Arthropod for presenting some features analogous to the Arachnida.

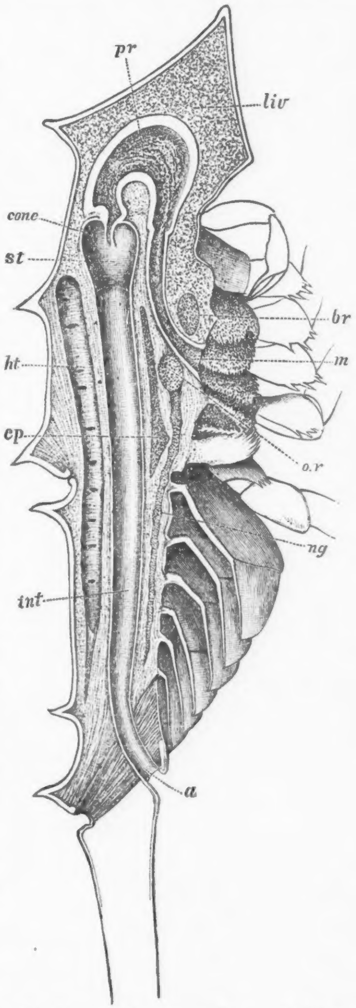



FIG. 13.—Section through a small *Limulus polyphemus* (much enlarged), to compare with a neocaridous Crustacean such as Apus: *liv*, liver; *pr*, proventriculus; *st*, stomach; *ht*, heart; *cp*, cartilaginous plate over the nervous system; *int*, intestine; *a*, anus; *br*, brain; *m*, mouth; *or*, œsophageal ring; *ng*, abdominal ganglia.

A study of the Phyllopoda and Phyllocarida must tend to confirm the view we have expressed as to the synthetic

or generalized nature of Limulus. While we have in another place endeavored to show in the light of A. Milne-Edwards' anatomical studies on Limulus, that it is an abnormal Crustacean and far removed from the Branchiopoda; there are nevertheless some points in which it comes in contact with the Phyllopoda, and which have been noticed ever since the time when O. F. Muller comprised Apus in his genus "*Limulus*." If the reader will compare the accompanying longitudinal section of Limulus with our section of Apus in Pl. XI, some striking resemblances will be seen; externally the front edge of the carapace, *i. e.*, the frontal doublure, so well adapted for burrowing in the mud; the relations of the hypostoma or labrum, and the retention of the ocelli, as well as the mode of molting the shell, are external points of resemblance, while internally the front part of the head filled with the lobules of the liver, the oblique long narrow, œsophagus, the position of the stomach under the eye so far in front in the head, the simple archi-cerebrum, the general form of the heart, and the gnathobases near the mouth are additional points of resemblance.

## EXPLANATION OF PLATE XI.

FIG. 1.—*Apus lucasanus* Pack. Seen from beneath. Enlarged 3½ times. *md*, mandibles.

" 2.—*Apus lucasanus* Pack. First antennæ.

" 2*a*.—*Apus lucasanus* Pack. End of the same magnified. The antennæ of both pairs drawn to the same scale.

" 3.—*Apus lucasanus* Pack. Maxilla, showing the (*a*) anterior and (*b*) posterior divisions of the free edge; *max*, the gill of the maxillipede.

" 3*a*.—*Apus lucasanus* Pack. Maxillipede, represented by the gill only.

" 4.—*Apus lucasanus* Pack. First leg giving (with some changes) Lankester's nomenclature of the parts; $ax^1$–$ax^4$, the pseudojoints; $en^1$–$en^6$, the six endites, with the gill and flabellum.

" 5.—*Apus lucasanus*. The oostegite, or part of the 11th pair of legs of the female containing the eggs; *os*, aperture of the sack; *fl*, modified flabellum; *x*, the greatly enlarged subapical lobe; *br*, the gill.

" 6.—*Limnetis brachyura* (Europe). $ant^1$, 1st antennæ; $ant^2$, 2d antennæ; *lab*, labrum; *sh. g*, shell gland; *int*, intestine; *ht*, heart; *add*, *ms*, adductor muscle; *oc*, ocellus; *md*, mandible; *liv*, liver.

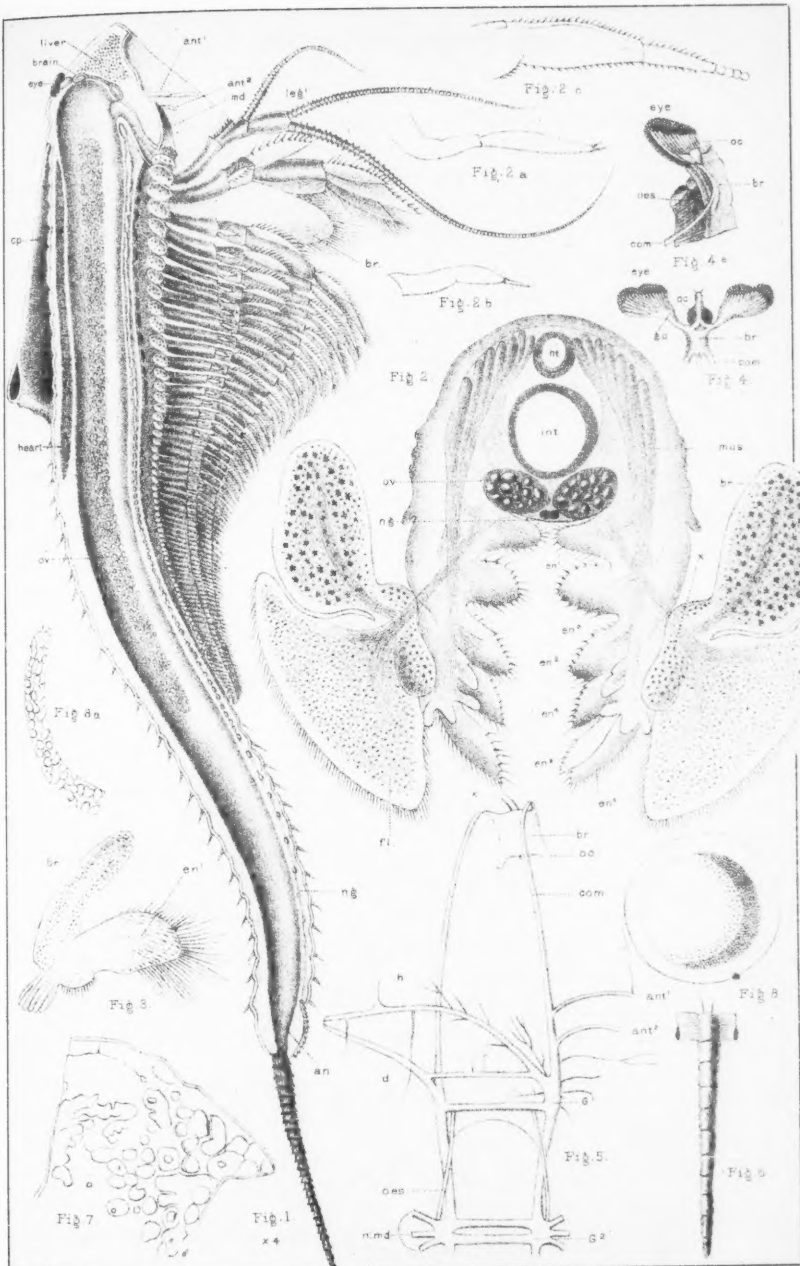
" 7.—*Limnetis brachyura*. Section through the body and shell (*sh*); *ht*, heart; *int*, intestine; *ov*, ovary; 1–6, the six endites.

" 8.—*Limnetis brachyura*. Brain (*br*) and nervous cord; *n.* $ant^1$, origin of the 1st antennal nerve; *n.* $ant^2$, 2d antennal nerve; *md. g*, mandibular ganglion; *mx. g*, maxillary ganglion; $G^1$, $G^2$, succeeding thoracic ganglia. Other letters as in Fig. 7.

" 9.—*Distomum apodis* Pack. AMER. NATURALIST, Vol. XVI, p. 142, Feb., 1882. Side view, greatly enlarged. A parasite in oostegite of *Apus lucasanus*.

" 9 *bis*. The same, ventral view.

Fig. 1 drawn from nature by J. S. Kingsley; Figs. 6–8 copied from Grube; the others drawn with the camera by the author.

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ANATOMY OF APUS.

EXPLANATION OF PLATE XII.

FIG. 1.—*Apus lucasanus* Pack. Section through the body, with the intestine removed. *md*, mandible; *ant*[1], *ant*[2], 1st and 2d antennæ; *leg*[1], first pair of legs; *br*, flabellum; *ov*, ovary; *ng*, ganglionic chain.

" 2.—Transverse section through the body at the 7th or 8th pair of feet, the shell removed, *mus*, dorso-ventral adductors of the feet, crossed by the adductors of the exites; *ht*, heart; *int*, intestine; *ov*, ovary; *n. g*, ventral ganglion; *en*[1]–*en*[6], endites; *br*, gill; *fl*, flabellum; *x*, subapical lobe.

" 2*a*.—1st antenna; 2*b*, 2d antenna; 2*c*, the extremity of 2d antenna, with four bead-like joints, showing the three imperfect joints, the third ending in a moniliform portion.

" 3.—Maxillipede with the gill (*br*) and single endite.

" 4, 4*a*.—Dorsal and lateral view of the brain of the European *Apus cancriformis*; *br*, brain; *com*, commissure to subœsophageal ganglion; *g. op*, optic ganglion; *oc*, ocellus; *œs*, œsophagus.

" 5.—Brain and part of ventral cord of *Apus cancriformis; oc*, nerve to ocelli; *ant*[1], *ant*[2], first and second antennal nerves; *G*[1], œsophageal; *G*[2], mandibular ganglion, sending off three mandibular nerves (*n md*); *d*, descending œsophageal nerve; *h*, unpaired or lower œsophageal ganglion; *œs*, nerve passing to the muscles of the œsophagus.

" 6.—Heart of *Apus cancriformis*.

" 7.—*Apus longicaudatus*, portion of embryonic membrane lying next to the chorion, and supposed to represent the amnion in Limulus; the nuclei in many of the cells have become absorbed.

" 8.—An egg of the same, showing the cellular nature of the amnion.

" 8*a*.—A portion of the same amnion seen sideways of the egg.

Fig. 1 drawn under the author's direction by J. S. Kingsley; Figs. 4, 4*a*, 5 and 6 copied from Zaddach; the remainder drawn with the camera by the author.

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# IDOLS AND IDOL WORSHIP OF THE DELAWARE INDIANS.

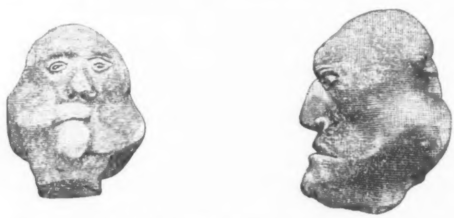
BY CHARLES C. ABBOTT.

JOHN Brainerd, while a missionary among the Indians of New Jersey, recorded of one of these people, that "she had an aunt * * * * who kept an idol image, which, indeed partly belonged to her, and that she had a mind to go and fetch her aunt and the image, that it might be burnt; but when she went to the place she found nobody at home, and the image also was taken away." While this, indeed, is slender evidence of the occurrence of idol worship among the Delaware Indians, it is of interest in showing that images were not unknown, and that they possessed other significance and value than as mere ornaments. Any carving in wood or stone, merely used for personal decoration would not have become sinful in the mind of an Indian woman, through the preaching of the missionary; and a desire to destroy the object she reported as in her possession, must necessarily have

arisen from the fact that it was regarded with superstitious reverence and invested with supernatural powers, in their belief.

Such "idols," however, unless usually made of material as perishable as wood, were of rare occurrence, if we may judge by the common experience of those who have been enthusiastic collectors of the ordinary stone implements of these people. Rude representations of the human face, it is true, have been quite frequently found; but the character of all these carvings is such as to suggest simply that they were intended merely as personal ornaments, and possessed no religious significance.

A recent discovery in New Jersey opens up the subject of the occurrence of "idols" among the Delaware Indians, and also furnishes another instance of the close relationship of the Ohio mound-builders and the Atlantic coast tribes. It has long been known to archæologists that elaborate carvings of the human head have been found, in mound regions, of such large size that their use as ornaments was impracticable, and their religious significance was therefore proportionately probable. Such a carving has been recently found in New Jersey, and is at present a unique specimen. For other reasons than this, however, it is of considerable interest. The brief but authentic history of this idol, if



Idol of the Delaware Indians.

we may so designate it, is this: It was found in clearing a previously uncultivated tract preparatory to building a dwelling house. The spot was covered with scrub pines, with an undergrowth of black huckleberry and, in the moister soil, of swamp blueberry. The drier soil, except some two inches of humus, was an exceedingly homogeneous yellow ferruginous sand; and the workman was impressed by the fact that his spade had struck a stone a few inches below the surface, as the spot was one so destitute of stone that the presence of one was deemed remarkable. His attention was also drawn to the fact that the stone seemed

to be "set fast." He therefore drove his spade down by the side of the stone, and then throwing his weight on the handle, by this means started the object, which "came up with a click." Thus was the head broken from its base; and most unfortunately, no effort was made at the time to recover the missing portion. Many efforts have since been made, but as yet without success.

These particulars are of interest from one important fact. It is evident that the relic as obtained is only a small portion of a large object, the character of which can only be surmised. That the portion remaining in the ground is quite large, is shown by the resistance it offered to the considerable force exerted to displace it, and which resulted in the fracture of the specimen. This evidence of the considerable dimensions of the entire object is of interest archæologically, from the fact that the greater the size of any such carving the equally greater probability that the object possessed a religious significance in the estimation of its aboriginal owner.

It is not improbable that the missing portion of this interesting relic is simply a square base without any work having been put upon it other than polishing. This is inferred from the fact that essentially similar, but even more artistic carvings have been found in Western New York and in Ohio, having only such plain square bases. In the thirteenth report of the regents of the University of the State of New York, there is given a description, with illustrations of several carvings, which bear a marked resemblance to the New Jersey specimen. Some of them, indeed, evidence so great skill on the part of the sculptor, that doubts have been expressed as to their being the handiwork of the Indians. The finding of the New Jersey carving would seem to bear directly upon this question, for the skill shown in the production of the latter, is evidence that the more artistic New York examples of supposed aboriginal carving were not beyond the attainments of the Indian carver. It should be borne in mind also that the accuracy with which celts, axes and trinkets of various patterns were shaped from the hardest stones, is of itself sufficient to show that a faithful portrait in an easily worked material, was quite within their capabilities.

The "idol" so recently brought to light from barren New Jersey sands, possesses all those characteristics of feature and expression peculiar to the Indians of the Atlantic coast. The

material is a compact argillaceous substance of a pale, olivaceous color. It is, in fact, an indurated clay-stone, and no doubt a nodule from the underlying cretaceous plastic clay cliffs on the shore of Raritan bay, near Keyport, New Jersey. These nodules abound in the clays just mentioned. The specimen shows, at the point of fracture, that this nodule is of unusual hardness, and has a clean conchoidal fracture. The slight depressions on the forehead are due to weathering, and the general condition of the surface indicates a considerable degree of antiquity. This fact, again, is of interest, as it adds to the series of facts already gathered concerning the handiwork of our coast tribes, which go to show that at the time of the Columbian discovery of the continent, the natives were not in as "advanced" a condition as they previously had been, and that the majority of the most artistic of their productions in stone, if indeed not all of them, were at that time veritable relics, and considered as such.

In the execution of the idol we have been considering, the artist has secured the peculiar Indian physiognomy, yet it has been from simple economy of labor given to certain salient points offered by the natural form of the nodule, the work being entirely limited to the front and upper part of the head. There is, strange to say, no labor given to the sides, the bunch-like prominences being left untouched, and the effect is produced of an irregularly winged aspect, somewhat Egyptian. This, of course, is purely accidental, and may be classed as one of those treacherous resemblances which have led to so much vain speculation as to the ethnic relationship of American and Egyptian civilizations.

The height of this fragmentary carving is five and one-half inches; the breadth, four and one-eighth. Curiously enough, these measurements are identical with those of two similar carvings found in Ohio, and nearly coincide with the measurements given of the specimens found in Western New York, to which reference has been made. Can, indeed, this uniformity of size be merely accidental? Does it not rather indicate that these similar objects, whether in the possession of mound-builders or coast tribes, had a like significance, and was it not in all probability religious in its character?

I am indebted to Professor Samuel Lockwood, of Freehold, New Jersey, for much of the information concerning the interesting object here described, and the details of its discovery. The specimen is in his cabinet.

# EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Posthumous fame is doubtless of greater benefit to the community at large than to the person commemorated by it. The former are taught the possibilities of life by the examples of those who have achieved much, and are stimulated by it to exertion and to success. One of the most impressive forms of commemoration is the erection of statues in public places. The general public, especially those who do not read, are compelled to learn history when it is taught in the object lessons of the sculptor's and painter's arts. It has been the custom to erect statues to successful military men from time immemorial, and the United States has not been slow to follow the example of older countries. European nations, both ancient and modern, have also made statues of their philosophers, statesmen and artists, and although America has not yet immortalized many of her own sons in this way, she will probably do so ere long. We have statues of Humboldt, Shakespeare and other foreign worthies in our parks, but very few of our own masters have been so commemorated. We therefore look with pleasure on the movements to erect statues to Professor Henry, to Longfellow, and to Alexander L. Holley. England will erect a statue to Darwin and place it in South Kensington.

But an excellent method of attaining the same end is the establishment of scholarships bearing the name of the person whose memory it is important to preserve. It is greatly to be hoped that the subscription for the endowment of the Leidy chair of anatomy in the University of Pennsylvania, will be successful. This proposition is the more meritorious, since it is designed to benefit the present incumbent, Professor Joseph Leidy, during his life, as well as to commemorate his services to science.

The American committee selected to prepare a fitting memorial of Darwin in this country, are considering the advisability, as we understand, of creating a scholarship bearing his name, which shall support an American student of biology at some of the best schools of Europe. It is to be hoped that such a desirable proposition may be carried into effect.

The Bi-Centennial Association of Pennsylvania has issued a circular which sets forth a plan for the creation of a series of

prizes for works in science and art, commemorative of the establishment of the Commonwealth by Penn two hundred years ago. The competitors must be natives or residents of Pennsylvania, and the sums awarded are $500 to $1000. The prizes will be mostly presented to the association by private persons, and will bear their names. A number of them have been subscribed. Such prizes, numerous in Europe, are rare here, and are a most effective method of stimulating the higher forms of intellectual effort.

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## RECENT LITERATURE.

LUBBOCK'S ANTS, BEES AND WASPS.[1]—This volume is a reprint, with some omission of details, of Sir John Lubbock's papers which were read before the Linnæan Society of London. The volume is mainly devoted to ants, with a few pages referring to bees and wasps. The book is an important contribution to animal psychology, and is almost entirely a fresh record of facts observed by the author, who only refers to the observations of other naturalists for the purpose of introducing his own. Lubbock is a patient and most impartial observer, and is reticent as to ultimate questions, his method being purely inductive. However, at the outset Sir John feels disposed to place the ants next to man in intelligence, a position which may be disputed, as purely reasoning processes are perhaps at least as frequently observed in the mammals and birds, particularly the domesticated kinds, as in ants or bees.

We will now rapidly note the original discoveries of our author, such as prove to be additions to our stock of knowledge of insect mental traits. Lubbock is the first to show that in ants (*Myrmica ruginodis*), the queens have the instinct of bringing up larvæ and the power of founding communities; and not queens only, but, as has been shown by Denny, Lespès, Dewitz, and proved by Forel, the workers will lay eggs which produce males. Lubbock has further proved that the worker eggs only produce males. While it has formerly been supposed that ants live but one year, Lubbock kept two queens over seven years, and they "are probably more than eight years old." They seem in perfect health, and in 1881 laid fertile eggs, a fact which suggests physiological conclusions of great interest. He also has workers "more than six years old."

While English ants do not, as in warmer countries, lay up food for the winter, "they do more, for they keep during six months the eggs which will enable them to procure food during the following summer, a case of prudence unexampled in the animal kingdom."

[1] *Bees, Ants and Wasps.* A record of observations on the habits of the social Hymenoptera. By Sir JOHN LUBBOCK, Bart. New York, D. Appleton & Co.

As regards the slave-keeping propensity of ants and its effect upon the ant character, we have many fresh observations. During more than four years' observations of a nest of Polyergus, Lubbock's specimens "certainly never fed themselves, and when the community changed its nest, which they did several times, the mistresses were carried from the one to the other by the slaves." With Huber he does not doubt that specimens of Polyergus, if kept by themselves in a box, would soon die of starvation, even if supplied with food. "I have, however, kept isolated specimens for three months, by giving them a slave for an hour or two a day to clean and feed them; under these circumstances they remained in perfect health, while, but for the slaves, they would have perished in two or three days. Excepting the slave-making ants and some of the Myrmecophilous beetles above described, I know no case in nature of an animal having lost the instinct of feeding." In *Polyergus rufescens*, the so-called workers, though thus helpless and idle, are numerous, energetic and, in some respects, even brilliant. In another slave-making ant, Strongylognathus, the workers are much less numerous and so weak that it is an unsolved problem how they continue to make slaves. They make slaves of *Tetramorium cæspitum*, which they carry off as pupæ. The extreme in the series of slave-making ants is Anergates, which differs from all other ants "in having no workers at all." The male is wingless; they and the females are accompanied and tended by *Tetramorium cæspitum.* The Anergates are absolutely dependent upon their slaves, and cannot even feed themselves. Lubbock thinks male and female Anergates make their way into a nest of Tetramorium "and in some manner contrive to assassinate their queen." As regards the effect upon the character of the ants, we quote as follows from our author:

"At any rate, these four genera offer us every gradation from lawless violence to contemptible parasitism. *Formica sanguinea*, which may be assumed to have comparatively recently taken to slave-making, has not as yet been materially affected.

"Polyergus, on the contrary, already illustrates the lowering tendency of slavery. They have lost their knowledge of art, their natural affection for their young, and even their instinct of feeding! They are, however, bold and powerful marauders.

"In Strongylognathus the enervating influence of slavery has gone further, and told even on their bodily strength. They are no longer able to capture their slaves in fair and open warfare. Still they retain a semblance of authority, and when roused will fight bravely, though in vain.

"In Anergates, finally, we come to the last scene of this sad history. We may safely conclude that in distant times their ancestors lived, as so many ants do now, partly by hunting, partly on honey; that by degrees they became bold marauders, and gradually took to keeping slaves; that for a time they maintained

their strength and agility, though losing by degrees their real independence, their arts and even many of their instincts; that gradually even their bodily force dwindled away under the enervating influence to which they subjected themselves, until they sank to their present degraded condition—weak in body and mind, few in numbers, and apparently nearly extinct, the miserable representatives of far superior ancestors, maintaining a precarious existence as contemptible parasites of their former slaves."

As to the passions of these creatures, Lubbock states that ants of the same nest never quarrel. "I have never seen the slightest evidence of ill-temper in any of my nests, all is harmony. Nor are instances of active assistance at all rare. Indeed, I have myself witnessed various cases showing care and tenderness on their part." As to their recognition of one another, it appears that it is not personal or individual, "their harmony is not due to the fact that each ant is individually acquainted with every other member of the community. At the same time the fact that they recognize their friends even when intoxicated, and that they know the young born in their own nest even when they have been brought out of the chrysalis by strangers, seems to indicate that the recognition is not effected by means of any sign or pass word." As to the power of communication, the results of a number of experiments taught our author that while they do not possess "any considerable power of descriptive communication," on the other hand, there can, he thinks, be no doubt but that they do possess some power of the kind. He concludes that his experiments "certainly seem to indicate the possession, by ants, of something approaching to language. It is impossible to doubt that the friends were brought out by the first ant; and as she returned empty handed to the nest, the others cannot have been induced to follow her merely by observing her proceedings. In face of such facts as these, it is impossible not to ask ourselves how far are ants mere exquisite automatons; how far are they conscious beings? When we see an ant hill, tenanted by thousands of industrious inhabitants, excavating chambers, forming tunnels, making roads, guarding their home, gathering food, feeding the young, tending their domestic animals—each one fulfilling its duties industriously, and without confusion—it is difficult altogether to deny to them the gift of reason; and the preceding observations tend to confirm the opinion that their mental powers differ from those of men not so much in kind as in degree."

While our author concludes that ants track one another by scent, he is inclined to adopt the mosaic theory of insect vision, and from experiments with the spectrum, concludes that "(1) ants have the power of distinguishing colors; (2) that they are very sensitive to violet; and it would also seem (3) that their sensations of color must be very different from those produced upon us." The sense of hearing appears to be lodged in the antennæ,

certain stethoscope-like organs occurring there, though ants are deaf to ordinary sounds, still he thinks that ants perceive sounds which we cannot hear. On the other hand the sense of smell is highly developed, and how important this is in enabling them to find their way is shown in chapter IX, where are some curious statements both as to their apparent want of ingenuity, especially in constructing bridges and earthworks. Ants while guided by scent are also guided by sight, and are greatly influenced by the direction of the light.

In the chapter on bees he records experiments showing that honey bees "do not bring their friends to share any treasure they have discovered, so invariably as might be assumed from the statements of previous observers," and he has been a good deal surprised at the difficulty which bees experience in finding their way. His observations also teach him that "though bees habitually know and return to their own hive, still, if placed on the alighting-board of another, they often enter it without molestation." He was unable to discover any evidence of affection among bees, they appearing "thoroughly callous and utterly indifferent to one another." Contrary to the usual statements, he finds their devotion to the queen to be "of the most limited character," and the workers take no notice of their dead companions. Bees possess a keen power of smell, but like ants the sense of hearing is very dull; they possess, however, a color sense, preferring one color to another, blue being distinctly their favorite.

A brief final chapter is devoted to wasps, and Lubbock's experiments, "in opposition to the statements of Huber and Dujardin, serve to show that wasps and bees do not in all cases convey to one another information as to food which they may have discovered, though I do not doubt that they often do so." They are also not affected by sounds, and they are capable of distinguishing color, "though they do not seem so much guided by it as bees are."

The book has appendices giving details of experiments regarding the recognition by ants of friends after long separation, and on the power of communication of ants and bees, with notes on the industry of wasps, for Lubbock's investigations more than confirm the general belief as to the great industry of all these insects.

The work is a magazine of facts, materials for farther work on animal psychology. It should stimulate our youth of both sexes who are in any way interested in the study of nature, to observe patiently and thoroughly the habits of our insects. Any one of ordinary capacity can make similar observations, even those who are busy in other directions, for all of Sir John Lubbock's works have been prepared in moments snatched in the intervals of the life of a great banker and busy member of Parliament.

LÜTKEN'S ZOOLOGY.[1]—As respects fullness of detail, and especially the illustrations and press-work, this compact volume makes a most favorable impression. The author, Dr. Lütken, has long been known as one of the leading zoölogists of Denmark, and in fact of Europe. He has published copiously on fishes, Crustacea and especially Echinoderms, being one of the first living authorities on the latter group of animals. The Scandinavian naturalists are distinguished for the care and accuracy of their work, and these qualities are without doubt characteristic of the work before us.

The plan of this zoölogy is somewhat like that of Peters and Carus' and Claus' zoölogy, and is designed for the advanced, working zoölogist. It will prove valuable for reference to the American student, especially on account of the admirable wood-cuts, many of which are new, while all have been drawn and engraved with evidently great fidelity. It begins with the vertebrates and ends with the Infusoria. Over half of the volume is devoted to the vertebrates, and much attention is paid to the ganoids, a strong point with the author, whose restorations of extinct forms are new and valuable. The arthropods and worms are placed above the mollusks, and among the latter appear the tunicates. The Scandinavian naturalists are slow to adopt radical changes in classification, and although we should differ with the author in some taxonomic matters, we congratulate his countrymen at having such an admirable hand-book placed in their hands.

GROTE'S ILLUSTRATED ESSAY ON THE NOCTUIDÆ OF NORTH AMERICA.[2]—This essay relates to the structure and literature of our Noctuidæ, an extensive family of moths which has formed the subject of many papers by Mr. Grote, whose faithful pioneer work on this group has rendered American entomology a lasting service. The notes on Mr. Walker's types in the British Museum are the results of a second examination of that collection. The section entitled "Specimens of North American Noctuidæ" is illustrated with four excellent chromo-lithographs, drawn by A. H. Searle, in London. The book is thoroughly well printed and bound, and is an important addition to our lepidopterological literature.

RECENT BOOKS AND PAMPHLETS.—Mission G. Revoil aux Pays çomalis, Faune et Flore. Reptiles et Batrachiens. Par M. Leon Vaillant.

Note sur les Cyprinodon du Groupe du C. calaritanus. Par M. H. E. Sauvage. Pl. III. From M. Leon Vailliant.

Report of T. B. Ferguson, Commissioner of Fisheries of Maryland, January,

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[1] *Dyreriget.* En Haand-og Lærebog til Brug ved höjere Læreanstalter.. (Lærebog i Zoologien Nr. I.) Af Chr. FR. LÜTKEN. Fjerde Udgave. Kjöbenhavn, 1882. 8vo, pp. 699.

[2] *An illustrated essay on the Noctuidæ of North America;* with "A colony of Butterflies." By AUGUSTUS RADCLIFFE GROTE. London, John Van Voorst, 1882. 8vo, pp 85. Price 10s. 6d.

1881, with appendix A. An account of experiments in Oyster culture. By J. A. Ryder. From J. A. Ryder.

Zur Würdigung der theoretischen Speculationen über die Geologie von Bosnien. Von Professor Dr. R. Hoernes. 1882. From the author.

Die Stegocephalen aus dem Rothliegenden des Plauen'schen Grundes bei Dresden. Von Hermann Credner in Leipzig. III Theil., 1882. From the author.

Rapport sur la Marche du Musée Géologique Vaudois en 1881. Suivi de la Classification Pétrogénique adoptée du Musée. Par E. Renevier. Avril, 1882. From the author.

Humboldt Library, No. 29. Facts and Fictions of Zoölogy. By Andrew Wilson, Ph.D., 1882. From the author.

On the Origin and Development of the existing Horses. By Jacob L. Wortman. Ext. from the Kansas City Review of Science and Industry, April and June, 1882. From the author.

Zur Kenntniss der mittel miocänen Trionyx-Formen Steiermarks. Von R. Hoernes. 1881. From the author.

Säugethier-Reste aus der Brauenkohle von Görlach bei Turnau in Steiermark. Von R. Hoernes. From the author.

Address by W. H. Dall, vice-president Section F, before the Section of Biology, American Association for the Advancement of Science, Montreal meeting, Aug. 23, 1882. From the author.

Conference sur l'Unification des Travaux Géographiques. Par M. B. DeChancourtois. 1879. From the author.

Transcription des Noms Géographiques en lettres de l'Alphabet Latin. Par M. B. DeChancourtois. 1878. From the author.

De l'Unification des Travaux Géologiques en general, et particulièrement en ce qui concerne les Figures Conventionnels. Far M. B. de Chancourtois. From the author.

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# GENERAL NOTES.

## BOTANY.[1]

SOME NEW SPECIES OF SPHÆRIACEOUS FUNGI.—The four species here described were found on petioles of *Sabal serrulata*, at Green Cove Springs, Fla., during the winter of 1881–2, by Dr. Martin.

*Diatrypella deusta* E. and M.— Perithecia coriaceous, flask-shaped, about 3 mill. in diam., buried in the substance of the matrix, without any distinct stroma or circumscribing line, in elongated clusters of 6–12, the obtuse imperfectly quadrisulcate ostiola raising the epidermis into distinct ridges which appear blackened as if carbonized, and are often split longitudinally along their crest; asci lanceolate, $57–75 \times 5\frac{1}{2}—7\ \mu$. Sporidia cylindrical, curved, yellowish, $5\frac{1}{2}–7 \times 1\frac{1}{4}\ \mu$

*Sphæria (Anthostomella) leucobasis* E. and M.—Perithecia globose or subelliptical, about $\frac{1}{3}$ mill. diam., buried in the matrix in definite groups, above which the epidermis is generally more or less blackened, the discolored patches mostly limited by a well-defined line which does not, however, penetrate deeply; ostiola obtuse, barely piercing the epidermis; asci cylindrical, 75–80 $\mu$ long; sporidia uniseriate, elliptical, brown, $11–13 \times 5\frac{1}{2}–7\ \mu$.

The substance of the petiole beneath the clusters of perithecia,

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

is partially bleached so that a longitudinal section shows dull white blotches which indicate the presence of the fungus.

*Sphæria sabalicola* E. and M.—Gregarious or scattered, perithecia coriaceous with rather thick walls, about $\frac{1}{3}$ mill. diam., covered by the epidermis which is raised into little obtusely conic projections around which the surface of the matrix is of a tawny color; asci clavate-cylindrical, $57 \times 8\ \mu$. Sporidia biseriate, oblong, 3-septate, brown, about $11 \times 3\frac{1}{2}\ \mu$.

*Sphæria sabalensioides* E. and M.—Perithecia scattered, minute, $\frac{1}{4}$ mill. diam., globose, covered, the short ostiolum barely piercing the epidermis and visible under the lens as a small black dot; asci $75-80 \times 7\frac{1}{2}-9\ \mu$. Paraphyses none; sporidia biseriate, elliptic-fusiform, appendiculate, yellowish, with a gelatinous envelop, $13-15 \times 3\frac{1}{2}-3\frac{3}{4}\ \mu$. The short filiform appendages at each end of the sporidia are soon absorbed.

*Sphæria sabalensis* Cke., to which this is closely allied, has much longer sporidia ($50\ \mu$.).

To the above described species, which appear to be quite distinct from any of the species on Sabal published by Berkeley and Cooke, may be added:

*Cercospora malvicola* E. and M. (N. A. F. No. 821).—Amphigenous, minutely tufted on withered spots in the leaf; hyphæ gray, nodulose, sparingly branched, $90-114\ \mu$. high; conidia terminal, narrow cylindrical or attenuated above, 5–7-septate, 75–95 $\mu$ long. Differs from *C. malvarum* Sacc., in its shorter hyphæ and conidia, duller color and orbicular spots.—*J. B. Ellis and Dr. Geo. Martin.*

New Fungi by J. B. Ellis.—*Cercospora cercidicola.*—On brown spots on living leaves of *Cercis canadensis.* Hyphæ fasciculate brown, $114 \times 3\frac{1}{2}\ \mu$., tips divaricate bearing the oblong-clavate, 3-septate ($30-38 \times 5-7\ \mu$.) conidia,

*Cercospora physalidis.*—Amphigenous on white deciduous spots 1–2 mill. in diam. Hyphæ brown subnodulose, $45-55 \times 5-5\frac{1}{2}\ \mu$.; conidia clavate-cylindrical, faintly 5–8 septate $65-75 \times 4\ \mu$. On leaves of Physalis.

*Cercospora euonymi.* — Amphigenous on small white round spots, 1–2 mill. in diam., with a dark purple border. Hyphæ subnodulose brown, about $60\ \mu$. high, conidia $50-65 \times 7-8\ \mu$. clavate-cylindrical 3–5-septate. On leaves of *Euonymus americana.*

*Cercospora asclepiadis.*—On *Asclepias cornuti.* Amphigenous, but mostly on the upper surface of the leaf, on suborbicular spots 1–3 mill. in diam., black at first but soon becoming white in the center, with a definite dark brown or nearly black raised border around which the leaf is stained purplish brown; hyphæ fasciculate subnodulose and sparingly toothed above, brown, $40-50 \times 4\ \mu$.; conidialinear clavate, about 5-septate, hyaline, $80-120 \times 3\frac{1}{2}-4\ \mu$.

Quite different from *C. clavata* Ger., which is also found on several species of Asclepias.

*Cercospora toxicodendri.*—Snow white on black spots 1–2 mill. diam. Hyphæ short, 25–30 × 5½ $\mu$., pale brown; conidia slender clavate, faintly multiseptate above, contracted below into a slender base, 50–60 × 5–6 $\mu$. On leaves of *Rhus toxicodendron*, Newfield, N. J.

*Septoria sisymbrii.*—On withered faded spots. Perithecia minute, erumpent, scattered or in groups of 3–4 open above as if the apex had been torn away; spores linear, 1–2 septate, 30–40 × 3–3½ $\mu$., mostly curved, ends rather obtuse. The spores scarcely differ from those of *S. siliquastri* Pass., but the habit is different.

*Septoria pruni.*—Perithecia immersed in dark brown deciduous spots, 1–3 mill. diam. Spores cylindrical curved, obtuse, 4–6-septate, 30–50 × 2 $\mu$. On leaves of *Prunus americana*.

The above species, except the one noted, were collected in the vicinity of Lexington, Ky., by Professor W. A. Kellerman.

The measurements are in millimeters (mill.) and micromillimeters $\mu$., *i. e.*, thousandths of a millimeter.—*J. B. Ellis, Newfield, N. J.*

Pacific Coast Botany.—Our botanists of the western coast are showing a most commendable activity, worthy of imitation by those of the older portions of the country. Not content with the possession of the finest local flora of any country in their "Botany of California," they are pushing on with a vigor which will without much doubt enable them to complete the systematic disposition of all their native plants long before it can be done for any other part of the United States. The fungi of the coast have been carefully collected and catalogued by Harkness and Moore; Anderson has helped to make known the seaweeds of the coast, many of which have been distributed in Farlow, Anderson, and Eaton's "Algæ Am. Bor. Exsiccatæ." The lichens collected have been submitted to Professor Tuckerman for study, while the mosses and ferns were admirably worked in "Botany of California." All this implies persistent collecting, and good collecting at that. That the search for plants is carefully carried on may be shown by a reference to our two botanical journals, the *Torrey Bulletin*, and the *Botanical Gazette*, in which descriptions of new species crowd upon one another in rapid succession. The sets of plants now offered by the many collectors bring the coast flora within the reach of every one. We have recently examined plants of several of these sets—notably those of G. R. Vasey, the Parrish Bros., San Bernardino, Cal.; M. E. Jones, now of Salt Lake City; J. G. Lemmon, of Oakland, Cal., and find them to be most excellent. Among the plants sent out by Parrish Bros., are some very interesting Southern Californian species new to science, or but recently

described. Likewise among Mr. Lemmon's ferns, are several new ones, and several other rare ones.

In Oregon, Professor G. H. Collier, of Eugene City, has just published a "List of the trees of Oregon," an eight page pamphlet, giving "the maximum observed height and diameter" of fifty-seven trees, with the local names and occasional remarks as to habitat or economic uses. Thomas Howell, of Arthur, Oregon, has also issued a "Catalogue of the Plants of Oregon" which, although defective in some particulars, is valuable as being based upon actual collections.

The last thing we have from our western botanists is Professor Rattan's third and much enlarged and improved edition of his "Popular California Flora." The introductory lessons contain many fresh notes and illustrations that are interesting, as for example, that on the germination of the big-root (*Megarrhiza*) on p. IX, and one on the germination of lupines on p. X. The Flora proper furnishes a handy manual for the study of the commoner and easier plants of Central California.

GRAY'S "CONTRIBUTIONS TO NORTH AMERICAN BOTANY."—In this we have: I. Studies of Aster and Solidago in the older herbaria, and, II. Characters of the new plants of certain recent collections, mainly in Arizona and adjacent regions. The first is of great interest to North American botanists, as it is the result of Dr. Gray's studies in the great herbaria of the old world, during his recent visit to England and the continent of Europe. The introductory paragraph is so suggestive that we reproduce it here entire.

"Aster and Solidago in North America, like Hieracium in Europe, are among the larger and doubtless the most intractable genera of the great order to which they belong. In these two genera, along with much uncertainty in the limitation of the species as they occur in nature, there is an added difficulty growing out of the fact that many of the earlier ones were founded upon cultivated plants, some of which had already been long in the gardens, where they have undergone such changes that it has not been easy, and in several cases not yet possible, to identify them with wild originals. Late flowering Compositæ, and Asters especially, are apt to alter their appearance under cultivation in European gardens. For some, the season of growth is not long enough to assure normal and complete development, and upon many the difference in climate and exposure seems to tell in unusual measure upon the ramification, inflorescence and involucral bracts, which afford principal and comparatively stable characters to the species as we find them in their native haunts. I am not very confident of the success of my prolonged endeavors to put these genera into proper order and to fix the nomenclature of the older species; and in certain groups absolute or practical definition of

the species by written characters or descriptions is beyond my powers. But no one has ever seen so many of the type-specimens of the species as I have, nor given more time to the systematic study of these genera. * * *

"It is noticeable that the herbarium of Nees von Esenbeck for Aster is not referred to. *I cannot ascertain what has become of it.* But the types of several of his species, or specimens named by him, have been met with in other herbaria, especially in that of Lindley, and that of Schultz, Bip., the latter now a part of the large collection of Dr. Cosson. As to Asters, I do not here attempt anything beyond a report of the main results of the study of certain principal herbaria; and I leave the high northern and far western species out of the present view."

## ZOÖLOGY.

Habits of Fresh-water Crustacea.—No one branch of biological study is now bringing forth more interesting and every way useful results than embryology. Throwing light as it does, not only on questions of classification and theoretical biology, but also on the application of such theories to practical life, this new science may be termed at once the root and most typical fruit of a revolutionized biology. No other science furnishes a better illustration of the value of minute, accurate study of the most common and apparently insignificant facts. Sets of isolated facts evolved by conscientious study of different men spring suddenly into line when once the clue is found, and the result may be a new law which renders all these facts eloquent.

To the systematist the merely external study of life histories is of greatest value as a check against redundancy in classification, and furnishes the only reliable method, among lower forms at least, of setting the bounds of species.

Many eminent monographers have been obliged to considerably augment the nomenclature of their specialty with names which, later, have proved to apply simply to larval or immature forms, on account of the impossibility of following the whole life history of each individual.

To confine ourselves to the class Crustacea, many instances of this sort could be recounted. The best known is perhaps that of the common Cyclops which in the earlier days of carcinology enjoyed as many as three names between its exclusion from the egg and maturity. The discovery of the earlier stages in the life of Cyclops opened a new vista in the whole subject, and now we recognize a "*Nauplius stage*" in the life-history of nearly every crustacean.

It has been more recently discovered that similar opportunities for error are afforded by the difficulty of distinguishing the ultimate stage in an animal's life. It has been shown that the functions of reproduction are anomalous in the lower animals. Espe-

cially is this true in Crustacea, in so much that their condition affords no sufficient evidence that the sexually mature animal is in its historically perfect form. The enthusiasm elicited by the discovery that certain amphibians, under some circumstances, reproduce during a larval stage, was almost unparalleled, but I believe it demonstrable that, not only species, but families of lower Crustacea are normally sexually mature in a stage preceding actual maturity.

We most naturally turn to the order Branchiopoda for a test, since the most remarkable cases on record of heterogeneous reproduction have recently been read in their history. We need only mention the parthenogenetic summer brood of Daphnia,[1] and the case of heterogenesis discovered by G. O. Sars in Leptodora,[2] in which Sars concludes that *L. hyalina* has both "dimorphous development and alternation of generations." Nor are we disappointed in looking among the Cladocera for examples of heterogenesis. During the winter semester of 1881–82, at Leipzig University, we had the opportunity of studying the development of *Daphnia magna* (=*schäfferi*), and among other interesting facts the following were elicited:

The development proceeds in very much the way described for Moina by Grobben.[3] The secondary or swimming antennæ have an evident palpus in the nauplius stage, however, which makes the parallel complete between Copepod and Branchipod Crustacea. The heart and circulatory system apparently is formed differently from the method given by Grobben. I may be permitted to say in this connection, that the circulatory system is much more complicated than hitherto described, and seems to originate about a mass of deutoplasm which surrounds the intestinal canal in the embryo, and which is a remainder of the food-yolk, "*Nährungsdotter*," of the egg. The embryo, in a comparatively early age, begins to differentiate the walls of the valves, which first appear as a fold over the maxillary region near the position occupied by the heart, and extends gradually backwards in a thick fold of turgid cells between which fluid flows. Quite remarkable is it that from the dorsal region a process extends, growing much more rapidly than the lateral portion till it reaches the membrane of the egg, when it curves downward and forwards till it reaches a position nearly half way from the extremity of the abdomen to the maxillæ. The method of growth of this tail-like appendage of the shell is obscure, but it seems to stand in close relation to the formation of the brood-

[1] See J. Lubbock; Phil. Trans., Vol. 147, p. 98.
Cfr. R. Leuckart: Archiv. f. Naturg., XXXI, and
v. Siebold: Wahre Parthenogenesis bei Schmetterlingen und Bienen.

[2] G. O. Sars: Om en dimorph Udvikling samt Generations vexel hos Leptodora, 1873.

[3] Die Entwicklungeschichte der *Moina rectirostris*, von Dr. Carl Grobben. Vienna, 1879.

cavity, and is the result of a secondary folding of the common shell envelop. At the close of the development in the egg, this "tail" lies between the valves of the shell, curved beneath like the tail of a frightened dog, although the frequent motions of the post-abdomen are not a little hindered thereby.

On its escape from the egg, the animal swims freely, and soon kicks this pliant appendage backward and upward till it assumes a direction parallel to the long axis of the body, and then very soon its unequal growth causes this tail to be somewhat elevated. The appendage probably serves as a support for the cast off skin in the molt, so that it cannot fall down upon the post-abdomen and then be broken off before that portion of the shell forming the inner covering of the brood cavity can be successfully molted —a danger especially incident to long forms with narrow brood cavities, and to young animals in which the shell is tender. (It may be for this reason that males, in which the part corresponding to the brood cavity is very narrow, and young females, have this spine, while adult females do not, for, as is well known, the males of all this section of the genus are spined through life.) Successive moltings increase the size of the animal, but the spine remains and increases correspondingly, giving the animal a very different appearance from the parent, which was not only of an entirely different form but totally without the spine.

Finally the young female produces eggs parthenogenetically, and is, therefore, according to our customary notions, an adult. We have here, therefore, a case of heterogenesis. Under circumstances where food is not sufficiently abundant, it seems certain that the above-mentioned state is the final one, and that the animal does not reach that condition which we name *Daphnia magna*, but remains in a stage which has received a different specific name.

The same process has since been observed in the case of *Daphnia pulex*, in Minnesota. Some of the so-called varieties are but age-forms. There is in each species what may be called a *post-imago* form, which is only assumed under favoring conditions. Without going into the synonymy of this genus, which will bear a revision in view of this and similar facts, we may safely say that in the Daphnidæ we find heterogenesis almost a rule, at least in the genus Daphnia.[1] We may add that every possible provision for the reproduction of these animals seems to be provided. (1) They are very prolific; (2) reproduce both sexually and parthenogenetically; (3) resist great extremes of temperature; (4) accommodate themselves to great alterations in the purity of the water; (5) the winter eggs are provided with a horny covering or *ephippium*, which permits them to be dried in a mass of mud or frozen in a cake of ice without destroying their vitality; (6)

[1] See Birge, Notes on Cladocera, Madison, Plate II, Fig. 6.

during mild winters both summer and winter eggs are produced, and the successive broods of young after producing agamic young, throw off an ephippium so that the pool is filled with eggs which are calculated to stand any vicissitude. Thus it happens that after a pond has been dried for a long time the first warm shower quickens in it swarming life. The above facts are more significant when we remember that the Cladocera are above all others among Crustacea, the most useful as purifying agencies. The greater number subsist entirely upon vegetable matter, and the only means they have of collecting it is by causing a current of water containing such minute particles as may exist in it to pass between the rotating jaws, though, perhaps, in some cases the labrum is sufficiently prehensile to grasp somewhat larger food. Certain it is, however, that these same minute animals form an indispensable agent in the economy of nature, purifying all our stagnant pools of the decaying vegetation floating therein. One who had given no attention to the number of these creatures would undoubtedly be surprised on carefully examining a given quantity of water from the nearest lake. Here are some figures.

In a quart of water taken by dipping from a lake near Minneapolis, the following were counted:

| | |
|---|---|
| Ceriodaphnia | 1400 |
| Daphnia | 9 |
| Simocephalus | 56 |
| Cypris | 50 |
| Cyclops | 28 |
| Amphipods (chiefly young) | 120 |
| Infusoria | 35 |
| Mollusks | 22 |
| Diptera (larvæ) | 100 |
| Hemiptera | 9 |

etc., all visible to the unassisted eye.—*C. L. Herrick.*

On the Habits of Cryptobranchus.[1]—Living examples of this Japanese salamander have rarely been brought to this country, and the following observations may be worth recording even if they merely confirm those of Hyrtl, Van der Hoeven and others, whose works I have not yet had an opportunity to consult.

This specimen is about seventy-five centimeters (2½ ft.) long, and was obtained for Cornell University through Professor H. A. Ward, who brought it by hand from Japan.

It is very sluggish, remaining quiet for hours in water, excepting for the respiratory movements presently to be described. Nevertheless it can display considerable activity, and upon one occasion escaped from a common wash-tub which was about thirty centimeters (1 ft.) deep. Out of water it appears uncomfortable, and crawls first in one direction and then in another,

[1] Read at the Montreal Meeting of Amer. Association for Advancement Science, August, 1882.

with frequent stoppages. It evidently seeks shelter from the sun, but gives no sign of discrimination between objects, walking against dogs and cats and people as readily as against wood and stone. The trunk is never lifted from the ground, and the compressed tail rests on one side, but the head and neck are sometimes raised.

The respiratory actions in deep water I have not accurately observed, but in shallow water, just covering it, the nostrils are raised above the surface at frequent intervals, a slight hissing sound is heard, and after the nostrils are again carried below the surface, a few bubbles of air escape therefrom and there are muscular movements about the neck. During an hour, in freshly changed water, these respiratory actions occurred at intervals varying from half a minute to twelve minutes, but usually the time was from two to four minutes.

No notice was taken of raw or cooked beef or fish, either floating at the surface, lying at the bottom or suspended just above the water.

But if bits of food are dropped close to the mouth or allowed to slide over the top of the head, or held at the lips, they are readily snapped up and swallowed, if not too large. After a time the head was moved slowly toward meat held about one centimeter from the lips, but I could not determine whether sight or smell were the sense concerned. Neither have I ascertained the function of the tubercles.

This specimen has now eaten the following articles: Beef heart, raw and boiled; blue-fish, raw and broiled; hard boiled white of egg, canned roast beef, raw lamb's heart, liver, diaphragm, thymus and lung, baked maccaroni. Evidently there is no difficulty in keeping the animal alive.

I hope to make careful observations of Cryptobranchus in comparison with Menopoma and Menobranchus.—*B. G. Wilder, Ithaca, N. Y.*[1]

Mammals of New Guinea.[2]—The Annals of the Museum of Natural History, Genoa, for 1880–81, contain a list of fifty-seven species of mammals collected in New Guinea by L. M. D'Albertis and A. A. Bruijn, illustrated with fourteen plates of new species.

The work of identification and description has been performed by Dr. Peters, director of the Berlin Museum, and G. Doria, director of that of Genoa.

In their introduction these gentlemen state that the Australian element in the New Guinea fauna is continually on the increase, as evidenced by the late discovery in that island of the genera *Tachyglossus*, *Dasyurus* and *Dromicia*. Thirty species of marsupials, forming almost the half of the known mammals of Papua, have been found, and, although almost all the species are peculiar,

[1] The habits of this species are described by Duméril and Bibron, Herpetologie Generale, IX, 1854, p. 165.

[2] Annali del Museo Civico di Storia Naturale di Genova, Vol. XVI, 1880–81.

they yet belong to Australian genera. Twenty-two species of marsupials are included in the list. Those described by our authors are *Phascogale dorsalis*, *P. pilicauda*, *Perameles rufescens*, *P. arvensis*, *P. longicauda*, *Phalangista angustivittis*, *P. Albertisii*, *P. pinnata*, *P. gymnotis*, and *Macropus papuanus*.

It is remarked that the genus *Phascogale* evidently takes the place in Papuasia of the insectivorous genus *Tupaia* of Malaysia. There is no pouch in this genus, and the females of the two new species differ in the number of their mammæ, of which *P. dorsalis* has four, *P. pilicauda* six. Six species of this genus are now known to inhabit the region.

*Perameles rufescens* is comparatively large, measuring 52 centimetres (1.′–9″) in total length. Five species of this genus are known to be Papuasian.

The genus *Phalangista*, as understood by our authors, includes *Dactylopsila*, *Pseudochirus*, *Distoechurus* (Peters), and *Cuscus*. Eight species are enumerated. *P. Albertisii* is a fine species, about 14 inches long, excluding the prehensile tail, which exceeds a foot in length; it is reddish-brown, shaded with black above, with an indistinctly-bounded black band along the back. *P. pennata* is of about the size of a dormouse, or smaller than a rat. In color this pretty little creature is yellowish-brown with two black bands passing from the forehead through each eye to the muzzle. The tail is naked above and below, but bears on its margins long hairs, causing the whole to resemble a feather. An adult female had a well developed pouch, containing a single young one; the mammæ were only two.

*P. gymnotis* is remarkable for its naked ears and short fur, and is less arboreal than its congeners. In size it exceeds *P. Albertisii*, as it is about a yard in total length. It is stated that *P. trivirgata* Gray, is found by Dr. Albertis to be entirely insectivorous instead of frugivorous, as was asserted by Wallace.

Only three examples of *Macropus papuanus* were taken, and unfortunately the skulls belonging to the two larger skins were lost, but the length of the sole of the hind feet was 10 inches, and D'Albertis asserts that it attains a stature but little inferior to that of *M. giganteus*. *Macropus Bruni* of Schlegel inhabits the islands Aru and Kei, while *Dorcopsis Mülleri* Schlegel, is found with *P. papuanus* on the eastern coast of New Guinea. The remaining kangaroos of the region are *Dorcopsis luctuosus* (D'Albertis) and two species of the tree-inhabiting genus *Dendrolagus*.

The discovery of the monotreme, *Tachyglossus Bruijnii*, described by Peters and Doria in 1876, is one of the most important in the field of geographical distribution, that had been made for several years. The French explorer, Leon Laglaize, has since procured some examples at a height of about 3500 feet above the sea-level, in the Karon mountains of New Guinea. The natives call it "Nokdiak" and chase it with dogs that follow it into its

deep burrows. Professor Gervais, after a study of this animal, has founded for it the genus *Acanthoglossus* on account of the spines at the tip of the tongue. In 1877, *Tachyglossus (Echidna) Lawesii* was described by L. P. Ramsay, of Sydney, from an example taken by the Rev. Mr. Lawes at Port Moresby. *T. Bruijnii* of the north of New Guinea, is near *T. setosus* of Australia, while *T. Lawesii* is the representative of the Australian *T. hystrix*.

Nineteen species of Cheiroptera are enumerated, and two others are known. Among these *Emballonura Beccarii* and *Vesperugo papuanus* are new. Many of the bats are Malaysian, Australian or Polynesian.

The only insectivore of the Papuan group, *Crocidura luzoniensis* (Peters), was probably introduced from the Molluccas; and to introduction New Guinea probably owes its single wild ungulate, *Sus papuensis* (Lesson).

Among the thirteen rodents of the list the cosmopolitan *Mus rattus* and *Mus decumanus* find a place, followed by six others of the same genus, four of *Uromys* (Peters) and one of *Hydromys* (Geoffroy).

Results of the Voyage of the Magenta.—Prof. A. T. Tozzetti, of the Museum of Florence, has published a list of the Brachyura obtained by the Italian frigate *Magenta* in its circumnavigation of the world. The list includes sixty-three species.

The same naturalist contributes valuable notes upon the Mediterranean cephalopods. Thirty-one species of Dibranchiata are enumerated, with many additional particulars respecting their distribution and habits. The hectocotyle of *Parasira tuberculata* Tozzetti (=*Octopus violaceus* Risso) contains a single spermatophore in the form of a filament rolled upon itself. This takes the place of the many smaller spermatophores of ordinary cephalopods. *Octopus troscheli* is a new species differing from *O. vulgaris* in dimensions, proportion of arms and body, and disposition of the acetabula. Other new species are *Octopus incertus*, *Sepiola major* and *Rossia panceri*. *Ornitholepus australis* a small pedunculated cirriped living upon the ends of the abdominal feathers of a puffin, *Priofinus cinereus*, has also been lately described by Professor Tozzetti. Nearly a hundred of these birds were taken by the *Magenta* in the South Atlantic and Indian ocean, and all were infested with this parasite upon the barbs and barbules of the central abdominal feathers, while those taken in the Pacific were free from it. The strangeness of this parasitism is heightened by the fact, that *Priofinus* is one of the most ærial of birds, only resting upon the water at long intervals. None of the other Procellaridæ taken in the same regions harbored a cirriped, but all the species were well supplied with Anoplura of the genera *Lipurus* and *Docophoroides*.

THE INK-BAG OF THE CEPHALOPODA.—The researches of M. Paul Girod upon a great number of Cephalopods of the North sea and the Mediterranean, researches carried on in several successive sojourns at Roscoff and Banyuls, have elucidated many points in the anatomy, physiology and development of the ink-bag of those mollusks. The ink-bag is a long, black, pyriform sac opening at the summit of a papilla upon the posterior lip of the anus, and consists of a large reservoir, and of an ink-gland attached to the posterior face of the reservoir, and communicating with it by means of a small round orifice at its upper part. This description differs from that of preceding naturalists, whose statements are to the effect that the secretory apparatus consists of a reservoir whose walls are thrown into folds circumscribing spaces which pour the products of secretion directly into it. In the decapods the gland is free and projects into the ink-sac, but in the octopods the walls of the glands are united for much of their extent with the wall of the reservoir.

Ink-sac and gland are enclosed in a common envelope, consisting of an external tunic of conjunctive tissue; a middle tunic composed of a bed of smooth transverse muscular fibers crossed by a layer of horizontal fibers, and succeeded by a layer of pigment cells; and an internal tunic constituting the special membranes of the gland and reservoir. At the mouth of the sac is a terminal ampulla, bounded at each end by a thickening of the conjunctive tissue of the wall of the sac with a corresponding ring of muscular fibers from the transverse layer, thus forming a double sphincter.

The ink-sac is lined with pigmented pavement epithelium, except the terminal ampulla, which is lined with cylindrical epithelium similar to that of the epidermis of cephalopods.

The gland is composed of undulating lamellæ, leaving between them spaces of variable form. These lamellæ, flat near the orifice of the gland, become concave as they recede from it, and thus form concentric cups enveloping a central whitish mass (formative zone), and becoming of a more vivid black as they are more distant from the center. Analysis of the black secretion proves it to consist of 60 parts of water, 30.5 parts of organic insoluble matters, a little less than one part of soluble organic matters, and 8.6 parts of soluble and insoluble mineral substances. Among the soluble inorganic matters are carbonic acid and the sulphates and chlorides of sodium, potassium, magnesium and lime, while among the insoluble matters are carbonate of lime, magnesia and peroxide of iron. Iron and copper are both present in the blood of the Cephalopoda, the latter metal as a component of hemocyanine, which plays in these creatures the role of hemoglobine in vertebrates. In the soluble organic matters neither urine, uric acid, xanthine nor guanine can be detected, so that the gland is proved not to be a depuratory urinary organ.

The greatest portion of the black pigment consists of an insoluble organic matter to which Bizzio has given the name of *melaine*, and the composition of which greatly resembles that of the pigment of vertebrates.

At the thirteenth day of the development of a cephalopod the anal invagination forms. This increases and divides into the ink-bag and rectum. The cellules at the blind extremity of the growing ink-bag multiply and form a thickening which is the commencement of the ink-gland. The study of the tissues and development of the ink-bag proves that the epithelium of ink-sac and gland is a continuation of the epidermis, and that the wall of the bag is a cutaneous fold.

M. H. de Lacaze-Duthiers has discovered and described in the gasteropods a gland secreting a pigment and having the strictest relations with the rectum, opening into the anus and closely applied to the end of the digestive tube. This anal gland is in relation to another gland (*glande pupurigène*) supplied at once with venous blood, and with venous blood that has passed through the renal body. A gland with a vascular distribution identical with the latter gland of the gasteropods, and with similar nervous connections, has been discovered in the cephalopods between the ink-bag and the gills, and thus M. Girod is impelled to admit the homology of the anal gland of the gasteropods with the ink-bag of the cephalopods.

Zoological Notes.—The Smithsonian Report for 1880 contains much interesting information relative to work done in connection with the National Museum, and concludes with a record of scientific progress, containing among other reviews, that of Dr. Theo. Gill upon zoölogy and of O. T. Mason on anthropology.——Dr. J. G. Fischer (Bonn, 1882) publishes some notes on the collection of snakes in the Royal Museum at Dresden, and descriptions of four new species of lizards from Australia, three of them without fore feet, and two of them types of new genera.——Dr. E. L. Trouessart gives a synoptic revision of the genus Semnopithecus, in which he recognizes thirty-one species.——Recent issues of the Bulletin of the Fish Commission contain a republished article upon the food of the shad, by E. R. Mordecai, M.D. The writer claims the discovery that shad feed and fatten on marine fuci. Also observations upon the development of the silver gar (*Belone longirostris*), by J. A. Ryder; on the cod and halibut fisheries near the Shumagin islands, by Dr. Krause; and a most valuable and exhaustive essay upon Oceanic Protozoa, considered as food for higher organisms, by J. A. Ryder. The entomostracous Crustacea are the great feeders upon the Protozoa, and in their turn furnish food for fishes. The writer always found the remains of food in the intestines, and once in the stomach of shad that were in fresh water. The food consisted of Entomostraca, larger Crustacea and Algæ.——Among other

matters the Proceedings of the U. S. National Museum contains a description of two new races of *Myadestes obscurus*, inhabiting respectively Southwestern Mexico and Guatemala, and the Tres Marias islands, by Leonhard Stegneger, and in the same Proceedings Mr. R. Ridgway describes two new Costa Rican birds, a new fly-catcher and a supposed new petrel from the Sandwich islands, a new owl from Porto Rico, and two new thrushes from this country, one from the Rocky mountains, the other breeding in New York.——The same Proceedings contain much ichthyological news, including a paper by Professor G. B. Goode on Benthodesmus, a new genus of deep-sea Trichiuridæ, allied to Lepidopus. The species was first described as *Lepidopus elongatus*, by F. E. Clarke, from examples taken in New Zealand, and has since been found on the Great Bank of Newfoundland. Messrs. Jordan and Gilbert publish a key to the species of Pomudasys (= Pristipoma) known to inhabit the Pacific coast of tropical America, eighteen in all, including *P. cæsius*, a new species, and describe thirty-eight new species of fishes from Mazatlan, and one from San Salvador. The genus Stolephorus (Engraulis) receives four additions, Tylosaurus (Belone) two, Gobiesox four, Muræna two, Ophichthys two, Lutjanus two. Among the features of the collection described was a specimen of a Malthe and one of Fierasfer, both new. Dr. T. H. Bean gives notes upon a collection of fishes, with descriptions of new species and of a new genus (Delolepis). In the same proceedings Dr. R. W. Shufeldt gives some valuable remarks upon the osteology of *Opheosaurus ventralis*.

## ENTOMOLOGY.[1]

BUFFALO TREE-HOPPER INJURIOUS TO POTATOES.—Some years ago we gave a short account of the transformations of this insect (5th Report on the Insects of Missouri, pp. 119–125). The Buffalo tree-hopper (*Ceresa bubalus* Fabr.) oviposits in young twigs of apple, pear and other trees, subsisting in its later stages upon the sap of these trees. It is a very common and widely distributed insect, but does become injurious to a serious extent. We were greatly surprised, therefore, by the recent receipt of a number of specimens from Mr. W. M. Heilman, of Annville, Pa., accompanied by the following note dated July 19th: "I mail you to-day a box of insects injurious to potato plants, and plants showing their *modus operandi*. The insects are probably a species of tree-hopper, and it seems strange to me that they should work on potatoes. They commenced work on potatoes in a young orchard about four weeks ago, and I have not found that they work or do any injury after their last molt or when they become winged. They averaged about fifteen specimens to the

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

plant. I find no insects but these on the plants, which, after being girdled by them, turn yellow and die. The insects are not near as numerous now as a few weeks ago."—*C. V. R.*

WOOD-BORING COLEOPTERA.—There are many Coleoptera of various families which live in the galleries made by other species in the hard wood of trees. Thus the galleries of Mallodon and other large Cerambycidæ, form the home of many other species after the original owner has left them. If these inquilines are much smaller than the maker of the gallery, there is, of course, no difficulty in recognizing them as inquilines that did not make the gallery themselves. If, however, they are nearly of the same size as the original burrower, it is difficult to decide whether or not the galleries they inhabit have been made by them. Thus Mr. Eichhoff, in his excellent work on European Scolytidæ, suspects that the genus Platypus uses the galleries made by other beetles. My own experience in the South, with the common *Platypus compositus* is as follows: When found in the thick bark of pine stumps, the larvæ doubtless bore themselves, as there is no other beetle found in their company which makes such smooth and straight galleries. If, however, they occur in hard wood, such as oak, hickory, hackberry, etc., the case appears to be different, and seems to confirm Mr. Eichhoff's statement, as I found them always associated with true boring insects, viz., *Colydium lineola* and *Sosylus costatus.* The galleries of these three species are undistinguishable, and it appears to me very probable that Platypus simply uses the old galleries made by the two Colydiid beetles just mentioned. The Histerid genus Teretrius is another instance of this sort where the inquiline can be readily mistaken for the maker of the gallery, but in this case the Teretrius is simply parasitic on Ptilinus and other boring insects. I also would call attention to the fact that Professor Riley discovered the larva of *Hemirhipus fascicularis* to be parasitic on *Cyllene picta*,[1] in whose galleries it was living. As the two species are of about the same size, the Hemirhipis might be readily taken for a true wood-borer.

Another observation bearing upon this subject I had recently occasion to make in a street in Washington, D. C. There was an old maple tree perforated on one side with numerous holes, made, I presume, by an Elaphidion or some other average-sized Cerambycid. The burrows had evidently long since been deserted by the original makers, but I saw protruding from four or five of them the heads of *Strongylium tenuicolle.* Upon investigation I found that the beetles had died in the vain effort to escape from the gallery, the entrance being much too small to let the body pass through. Now I know by experience that Strongylium is not a true boring insect, and lives only in the very soft wood of decaying trees, especially of oak. It appears to me probable, there-

[1] Vide 1st Report U. S. Entomological Commission, p. 304.

fore, that the parent Strongylium had laid eggs at the entrance of a gallery made by a species smaller than itself, and that this mistaken instinct resulted in the death of its progeny in the manner just described.—*E. A. Schwarz, Washington, D. C.*

Bacterium a Parasite of the Chinch Bug.—In the course of some experiments made last month upon the chinch bug, I was annoyed by the rapid disappearance of the bugs under observation, which were on some hills of corn transplanted to the laboratory. Unable to find any evident cause of the phenomenon, I crushed a number of those remaining alive, and examined the fluids from their bodies under the microscope. In every case these were found to be swarming with a species of Bacterium not easily distinguishable from *B. termo.* The observations were many times repeated with every precaution against accidental infection, but with the same results. Using water freshly distilled and re-distilled, passing slides, covers and the tools used through the flame of an alcohol lamp at every step of the operation, I still found the same Bacterium in thousands in every preparation, but much the most numerous, as a rule, in the oldest specimens.

Careful search in the juices of the corn upon which the insects were feeding, failed to discover anything of the kind there. If a bug were thoroughly washed in a drop of distilled water, no Bacteria occurred in the water, showing that they were not derived from the surface of the insect. When a number of the bugs were kept for a week in a bottle without food, the Bacteria were found to have greatly increased in numbers, and were especially abundant in those which were recently dead. When the legs and head were cut off in a way to avoid injury to the alimentary canal, and crushed by themselves upon a slide, no Bacteria were found; and if the thorax and abdomen were crushed on separate slides, that containing the latter showed, as a rule, the greater numbers.

Careful dissections of the chinch bug were next made, for the purpose of ascertaining whether the seeming parasites could be traced to the alimentary canal. In five cases I succeeded in isolating the digestive organs, transferring them to a slide, and crushing them with the covers in distilled water. In all these cases the Bacteria were very abundant, and could be seen issuing from the stomach in adherent masses, and also in motion separately in all parts of the field. In two cases where a comparison could be made between the contents of the anterior and posterior parts of the canal, they were found much the most numerous in that part of the canal posterior to the malpighian tubes. On the other hand, Bacteria were also found in the water in which the dissections had been made; but as it is probable that the intestine was more or less torn in preparing the object, these may have escaped from its cavity. None were found in the ganglia of the nervous system in the only case in which I examined these

structures for them. From all this I conclude that they have their principal, perhaps exclusive, seat in the alimentary canal.

Similar experiments made upon chinch bugs taken from the field, gave similar results throughout; but nothing of the sort could be detected in the fluids of corn plant louse (*Aphis maidis*) feeding upon the same stalks, nor in any of a number of insects examined.

To-day (Aug. 17) I noticed that the chinch bugs in the field from which most of those experimented on were taken, were much less numerous than three weeks ago; and many dead bugs, both young and old, were found behind the sheaths of the corn. The mortality, from whatever cause proceeding, had evidently taken principal effect on the older individuals, as in this field not more than two per cent. of those living had reached the "pupa" state, and no winged specimens were seen, while in other fields, from half a mile to a mile distant, about nine-tenths were pupæ, and many adults occurred. I collected a number of bugs, both living and dead, from this situation, and found the Bacteria excessively abundant in all examined.

The objectives used in these studies were usually Beck's tenth-inch water immersion and a No. 7 Gundlach. For a more careful study of the Bacteria, and for a comparison with *Bacterium termo*, I used, in conjunction with Professor T. J. Burrill (whose studies of Bacteria are well known), a tenth-inch Spencer's homogeneous immersion and a fifteenth-inch Tolles' of recent make, likewise a homogeneous immersion lens.—*S. A. Forbes, State Lab. of Nat. Hist., Normal, Ill.*

ON THE MOUTH OF THE LARVA OF CHRYSOPA.—Recently I had the opportunity of watching in a live box, under a low power of the microscope, the seizing and devouring of some plant-lice by the larva of an undetermined species of Chrysopa, and was interested in the manner in which it emptied the body of its victims. The jaws are large, hooked, pointed and tubular, with a small opening at or near the points. Approaching its prey the body of the Aphis is grasped by the hooked mandibles which at the same time pierce it. The Chrysopa larva remains stationary, and proceeds to pump its victim dry. At the base of each of the mandibles the integuments are dilated into a sac-like form capable of expansion and compression at will, a portion of the thorax is similarly constructed, and it is by the repeated dilating and compressing of these sacs that the fluid contents of the body of the Aphis are transferred through the tubular mandibles to the stomach of the Chrysopa larva.

When the abdomen of the Aphis has been emptied, the points of the mandibles of the Chrysopa larva are thrust in the thorax, and forward into the head in every direction, and in a few moments nothing remains of the once plump plant louse but a

shrivelled skin. In the authors accessible, I can find no reference to these elastic bulb-like sacs at the base of the mandibles, nor to the peculiar structure of the thorax, which admits of its expansion and contraction as referred to.—*William Saunders, London, Ont., read before the A. A. A. S., at Montreal.*

MOTHS ATTRACTED BY FALLING WATER.—Mr. J. Starkie Gardner records in *Nature*, March 9, 1882, his observation made in Iceland, that the gleaming water-falls seem to be as attractive to moths as artificial light—moth after moth flying deliberately into the falling water. This fact can, of course, be observed best in a country like Northern Iceland where there is no night during the summer.

A NEW MUSEUM PEST.—Mrs. A. E. Bush, an esteemed correspondent of San José, Cal., complains lately in her letters of the ravages of a Dermestid in her insect collection, and from specimens, larvæ and imagos, lately sent to us, we find that the species in question, is the handsome *Perimegatoma variegatum* Horn. We do not find that this species was ever known before as a museum pest, and there is danger that it may become distributed in insect collections all over the country, just as have the other species of the same family, which are so well-known and dreaded by entomologists.

FLEAS FEEDING ON LEPIDOPTEROUS LARVÆ.—Mr. Chas. I. Boden records in the (London) *Entomologist* for March 1882, p. 71, that he observed fleas feeding upon Lepidopterous larvæ. The great abundance of fleas in our Southern States, in places remote from human habitations and where there are presumably few warm-blooded animals or none at all, may perhaps find explanation in this insect-feeding habit.

## ANTHROPOLOGY.[1]

BRITISH ANTHROPOLOGY. — The York volume, 1881, of the British Association is at hand, and enables us to see what our brethren are doing. That portion of the work interesting to the readers of the NATURALIST will be the following:

The presidential address by Sir John Lubbock was a résumé of the progress of science during the fifty years of the association, and, as might be expected, contains valuable allusions to anthropology.

Professsor W. H. Flower chose as the theme of his opening speech before the department of anthropology, The low state of interest in anthropology in Britain compared with other countries.

The following papers are reported in abstracts:

The Viking's ship discovered in Sandefjord in Norway, 1880. By J. Harris Stone.

[1] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

Earthworks at Flamborough and Yorkshire wolds. Maj.-Gen. Pitt-Rivers.
Composite Portraiture. By Francis Galton.
Ancient dwellings found on Yorkshire wolds. By I. R. Mortimer.
The origin and use of oval tool-stones. W. J. Knowles.
Flint implements in stratified gravel near Thebes. By Maj.-Gen. Pitt-Rivers.
Report of the Anthropometric Committee.
A collection of racial photographs. By J. Park Harrison.
Scandinavian and Pictish customs on the Anglo-Scottish border. By Dr. Phené.
The geographical distribution of mankind. By Miss A. W. Buckland.
The Papuans and Polynesians. By C. Staniland Wake.
Excavations at Ambresburg banks in Epping forest. By Maj.-Gen. Pitt-Rivers.
Relations of stone circles to outlying stones or tumuli or neighboring hills. By A. L. Lewis.
Saw cuts and drill holes in hard stones of primeval Egyptian period. By W. Flinders Petrie.
Relations of the Hebrew, &c., alphabets and the Khita inscription. By Hyde Clarke.
Colonization of Cyprus and Attica in relation to Babylonia. By Hyde Clarke.
Animism of the Indians of British Guiana. By Everard F. im Thurm.
Origin and primitive home of the Semites. By G. Bertin.
The utilization of memory. By George Harris.
The cultivation of the senses. By George Harris.
Traces of Man in the Crag. By H. Stopes.
Excavations in the caves of Cefu, N. Wales. By Professor T. Mck. Hughes and Mrs. Wm. Wynn.
A Roman bronze galeated bust. By Professor Hughes.
Celtic engravings on a slate tablet from Towyn. By J. Park Harrison.
Physical characters and proportions of the Zulus. By C. Roberts and George W. Bloxam.
Stone implements from Asia Minor. By Hyde Clarke.
Profile of the Danes and Germans. By J. Park Harrison.
Remarkable human skull found near York. By Edward Allen.

Anthropology in France. — The Bulletins of the Société d'Anthropologie, though somewhat slow in making their appearance, are well edited. By an inspection of the titles given below it will be seen that the society still pursues with assiduity those biological investigations which have all along made it famous. The following papers in the volume of 1881, have more than a local interest:

Ardouin.—Craniologie des criminels, 709.
Statistique medicale du Japon, 717.
Bordier.—Recherches ethnographiques dans le Mackensie, 57.
Cartailhac.—Archéologie prehistorique en Portugal, 281.
Chervin.—Population de France en 1881, 790.
Chudzinski.—Trois encephales des Esquimaux, 312.
Splanchnologie d'un orang bicolere, 19, 172.
Un cas d'atavism, 626.
Anomalie du muscle abducteur du pouce, 748.
Corre.—Crânes de criminels, 638.

Dally.—Degenerescences humaines, 339.
Dareste.—Deviation chez un Agneau, 816.
Delaunay.—Pathologie generale, 803.
Duchesne.—Anomalies regressives, 329.
Foley.—Les Polynesiens, 264, 339, 545, 537.
Fontan.—Dents supplementaires chez les Neo-Caledoniens, 595.
Hayem.—Le Sang au point de vue anthropologique, 72.
Houel.—Hermaphrodites, 554.
Laborde.—Role fonctionnel des canaux semi-circulaires, 797, 819.
La Quesnerie.—Momies et autres objects du Perou, 550.
Le Bon.—Photographie des Fuegians du Jardin d'acclimation, 758.
Ledouble.—Sur les muscles, 111, 256, 654, 657.
Letourneau.—Les Akkas, 238.
Manouvrier.—Poids du crâne, 662.
Les Fuegians, 766.
Metchnikoff.—Des Origines japonaises, 724.
Mortillet.—L'ambre, 264.
Nadaillac.—L'Homme tertiaire en Italie, 260.
Parrot.—Crâne naviforme d'une idiote, 173.
Megaloglossie et idiotie, 752.
Quatrefages.—Nain microcephale, 752.
Royer, Mme.—Peuples Kymriques, 241.
Le Bien et la Loi Morale, 592.
Soldi.—L'Emploi du fer en Egypte, 34.
Tenkate.—Crânes malais, 37.
Thulie.—Instructions anthropologiques sur les Bochimans, 353.
Topinard.—Du Bord inferieur des naunes, 184.
Atrophie senile, 232.
Types indigenes de l'Algerie, 438.
Methode d'observation sur le vivant, 517.
Goniometre, 616.
Torok.—Crâne du jeune gorilla, 46.
Crânes Valaques. 175.
Ujfalvy.—Peuples de l'Inde, 598.
Vinson.—Calculs de têté, 124.
Vlasto.—Instruments en pierre de Brésil, 206.
Vogt.—Squelette humain associe aux glyptodontes, 693.
X.—Deformations artificielles et des mutilations, 632.
Zabarowski.—La memoire et ses maladies, L'Aphasie, 514.

ANTHROPOLOGICAL NOMENCLATURE.—In every science there are three stages of investigation, which we may represent by the Greek words γράφη, λόγος, and νόμος. Upon these terms as a basis we may construct a system of nomenclature for our science, and the following is offered in a tentative way for the emendation and criticism of my professional brethren. As the origin of man is as yet a mere speculation, I have not included it in the three-fold division. The whole study of the natural history of man would stand as follows:

ANTHROPOGENY.

| *Observing and Descriptive Stage.* | *Inductive and Classifying Stage.* | *Deductive and Predictive Stage.* |
|---|---|---|
| (γραφή.) | (λόγος.) | (νόμος.) |
| Anthropography | Anthropology | Anthroponomy |
| Archæography | Archæology | Archæonomy |
| Biography | Biology | Bionomy |
| Psychography | Psychology | Psychonomy |
| Phrenography | Phrenology | Phrenonomy |
| Ethnography | Ethnology | Ethnonomy |
| Glossography | Glossology | Glossonomy |
| Technography | Technology | Technonomy |
| Sociography | Sociology | Socionomy |
| Pneumatography | Pneumatology | Pneumatonomy |
| Daimonography | Daimonology | Daimononomy |
| Mythography | Mythology | Mythonomy |
| Hexiography | Hexiology | Hexionomy |

THE SIOUAN OR DAKOTA STOCK.—Major Powell, through the Bureau of Ethnology, is rewriting the linguistic stocks of North American Indians. Commencing with the labors of Gallatin, Hale, Gibbs and Trumbull, he has called in the aid of specialists like Dorsey, Gatschet, Hinman and Mason, to bring the subject even with our latest knowledge. The following is Mr. Dorsey's division of the Siouan stock:

Group I.—Dakota (Sioux) includes all the tribes of Dakota with the Asi′-ni-bwa$^n$, Stone Dakotas (Trumbull).

(Sioux is an abbreviation of Naudowessioux, a Canadian French corruption of a name given to the Dakotas by a hostile people. The real name of the Assiniboins seems to be Ie-ska-pi, they who speak white, intelligibly. They speak a dialect of Dakota, being an offshoot of the Ihauk-to-wa-na gens, and are called Hohe, rebels, by the Dakotas.)

Group. II.—Dhegiha. (A) Omaha-Dhegiha, includes Omahas and Ponkas,
(B) Kwapa-Dhegiha, includes Kwapas, Osages and Kansas. (Mr. Dorsey's first volume, Contributions to North American Ethnology, Vol. VI, relates to the Dhegiha language.)

Group III.—Tciwére. (A) Tciwére, or Otos and Missouris.
(B) Tcekíwerẹ, or Iowas.

Group IV.—Hotcañ′gara, or Winnebagos.

Group V.—Númañkáki (Mandans). Formerly in two villages, speaking as many dialects. (A) Mitutahañkuc, and (B) Ruptari.

Group. VI.—Hidhatsa. (A) Hidhatsa = Minnitaris and Gros Ventres.
(B) Absároki = Kiqatsa or Crows.

Group VII.—Yesa$^n$ (Tutelos) in Canada near Niagara falls.

THE NATIONAL MUSEUM.—Since it has been decided to make the new National Museum at Washington anthropocentric in its arrangement, anthropologists should watch with ever-increasing interest the unfolding of the scheme. To further this object circulars are issued, which any student may have for the asking, setting forth the progress of the work. Circular No. 17 has just

appeared, but No. 13 is the one to which especial attention is asked. Did our space allow we should publish it in full, but enough is furnished to show the grand scheme which Professor Goode has in mind.

OUTLINE OF A SCHEME OF MUSEUM CLASSIFICATION.

| *Divisions.* | | *Classes.* |
|---|---|---|
| I. | Mankind (Biology, Ethnology, Biography) | 1–3 |
| II. | The Earth as Man's abode (Hexiology) | 4–10 |
| III. | Natural Resources (Force, Mineral, Vegetal, Animal) | 11–15 |
| IV. | Exploitative Arts and Industries | 16–20 |
| V. | Elaborative Industries | 21–38 |
| VI. | Ultimate products and their utilization | 39–47 |
| VII. | Social Relations of Mankind | 48–54 |
| VIII. | Intellectual Occupations of Mankind | 55–64 |

Since Professor Goode invites criticism, the NATURALIST desires to further his wishes by urging upon anthropologists to procure circular 13 and to give him the benefit of their experience.

## GEOLOGY AND PALÆONTOLOGY.

MAMMALIA IN THE LARAMIE FORMATION.—Mammalia, which have been so long looked for in vain in the Laramie beds, have at length been found. Mr. J. L. Wortman, who was sent to explore this formation the past season, was instructed to look especially for Mammalian remains. He now announces that he has found them in place and mingled with Dinosaurian remains in such a manner as to admit of no doubt of their contemporaneity. Two species have come to hand, of which the following only is determinable.

*Meniscoëssus conquistus*, gen. et sp. nov.—But one specimen of this animal was found, and that is represented by two molar teeth and a distal extremity of a humerus. Were it not for the associated molar tooth, I should think that the second tooth might be that of a herbivorous reptile. It is probably a fourth premolar of the general type of that of the *Plagiaulacidæ*.

*Char. gen.*—Fourth premolar with a compressed anteroposterior edge, which is studded with denticles; sides without ridges. Posterior molar rather small; crown with three longitudinal series of tubercles, of which many have crescentic sections.

This form is plainly not a distant relative of the *Plagiaulacidæ*, recently described in the NATURALIST, from the Puerco Eocene of New Mexico, and it may enter that family. Its molar has the same number of rows of cusps as in *Polymastodon* Cope. The tooth is, however, of especial interest from its resemblance to the molar of the genus *Stereognathus* Owen, from the Oölite of England, showing clearly that that genus, whose affinities have been hitherto unknown, must be referred to the neighborhood of the *Plagiaulax* of the same great Jurassic period. The humeral condyles have the remarkable characters of those of *Catopsalis*.

*Char. specif.* — The premolar is large as compared with the molar, but the disproportion is not so great as in *Ptilodus mediævus.* It has one side convex and the other plane, and each is bounded by a cingulum at the base. The sections of the denticles are ovals, transverse to the edge of the crown. The grooves which separate them are continued downward on the convex face, but not on the plane face. The enamel is minutely wrinkled. One end of the crown is lost, as it is also in the true molar. The latter has the crown expanded laterally, so that the longitudinal grooves are wide open, and not closed as in *Catopsalis.* The median ones are transverse crescents in section; those of one edge are half crescents, and those of the opposite edge are the least, and are transversely oval in section. In the fragment the number of lobes is 4–3–4; the last row of small cusps being complete, and turning into the median at both extremities. No cingula. Elevation of crown of P-m. IV, .007; width of do. at base, .006; width of molar, .006.

This species was about the size of the Australian bandicoot, and was probably a true marsupial.—*E. D. Cope.*

A NEW FORM OF TÆNIODONTA.—The Puerco beds of New Mexico continue to produce new types of Mammalia. The genus now to be described is probably a Tæniodont, and allied to *Calamodon*, but the absence of the canine teeth renders the determination incomplete. The incisors, while of the form of those of *Calamodon*, had a limited period of growth, and the root displays a contracted base. The enamel also extends but a short distance on the anterior face of the tooth. The probable first inferior incisors are quite small, but are generally like the second or large ones. The superior molars have but a single conic root, but in some of them a fissure of the external side marks the usual place of division. The crowns are narrow and transverse to the axis of the jaw. I call this genus *Hemiganus*, and the species *H. vultuosus.*

*Char. specif.*—Large incisors strongly curved, robust, wearing with a strong posterior shoulder. Shaft with the dentine finely and sharply ridged. Inferior apex compressed; front regularly rounded. Enamel ? ridged or smooth. Superior molar with narrowed transverse crowns, and roots covered with a thin layer of cementum. There are one, perhaps two external cusps, but the crowns are all much worn. One crown, perhaps inferior, is subround with a notch, as in *Calamodon* sp. Enamel short, with equal base, smooth. Length of first incisor, .026; diameter of crown, anteroposterior, .008; transverse, .014. Length of second incisor, .094; diameters of crown, anteroposterior, .029; transverse, .019. Length superior molar, .0225; diameters crown, anteroposterior, .010; transverse, .017. Diameter inferior molar (second specimen), anteroposterior, .011; transverse, .011. Dis-

covered by D. Baldwin in New Mexico. The species is a little larger than the *Psittacotherium multifragum*.—*E. D. Cope.*

THE PERIPTYCHIDÆ.—The structure of *Periptychus* has remained uncertain so far as regards the limbs and feet. As these parts have much significance, I point out some of their characters as seen in specimens recently received from the Puerco beds.

The brain is, as in *Phenacodus*, very small, with the olfactory lobes widely separated from the small hemispheres. The humerus has an epitrochlear foramen. The astragalus has no trochlear groove, and the neck is short. The head is convex, and presents a lateral face for contact with the side of the cuboid. Five digits on the posterior foot. The lateral ungues are rather narrow hoofs. Cervical vertebræ very short.

The absence of trochlea of the astragalus is a point of resemblance to *Meniscotherium*, and separates *Periptychus*[1] from the *Phenacodontidæ* as a family type, which I call the *Periptychidæ*. With it must no doubt be associated *Anisonchus* Cope, *Haploconus*, and the following new genus.

*Hemithlæus kowalevskianus*, gen. et sp. nov. *Char. gen.*—Dentition of the type of *Anisonchus*, but there is but one internal tubercle of the superior true molars, which is the apex of the V, the posterior cusp being absent, no intermediate tubercles. Last and penultimate premolars with internal cusp. Last inferior true molar with heel.

*Char. specif.*—The internal lobes of both third and fourth premolars are conic. The true molars are distinguished from the species of *Anisonchus* and *Haploconus* in that the posterior cingulum does not develop an internal cusp. Instead of this, the apex of the median V forms the internal angle of the crown, and an anterior and a posterior cingula of equal size rise to meet it. The inferior molars have anterior and posterior median cusps, and the internal anterior cusp is not compressed. Length of P-m. IV with true molars, .0185; diameters P-m. IV, anteroposterior, .005; transverse, .007; do. of M. II, anteroposterior, .0046; transverse, .007. The last true molar is smaller than the first or second. Two individuals from the Lowest Puerco. Larger than *A. sectorius*. Dedicated to the distinguished palæontologist, Dr. W. Kowalevsky, at present traveling in this country.

In the August number of the NATURALIST it was shown that there are species of *Haploconus* with the interior lobe of the fourth premolar conical. I now find a species of *Anisonchus* which presents the same peculiarity. I describe it as follows:

*Anisonchus coniferus*, sp. nov.—Three individuals of larger size than the *H. kowalevskianus*. This species differs materially from the last in the larger development of the cingular internal cusp of the superior true molars, so that the transverse diameter of the latter

[1] *Catathlæus* was established on the permanent dentition of *Periptychus*.

exceeds that of any of the species of this group. The apex of the median V is not very prominent. Third superior premolar with a rudiment of the anterior and posterior basal lobes; internal lobe not large, conic.. Fourth not wider than first true molar, which equals the second and exceeds the third in size. An external cingulum on the true molars, none on the premolars. Probable inferior true molars with anterior and posterior median cusplets. Length of base of four last molars, .020; width of base of P-m. III .006; length of do., .005, do. of P-m. IV, .008; length of do., .007. Diameters of M. II, anteroposterior, .005; transverse, .0095. From the Lowest Puerco. D. Baldwin.—*E. D. Cope.*

SOME NEW FORMS FROM THE PUERCO EOCENE.—*Mioclænus protogonioides*, sp. nov. The largest species of the genus, represented by the superior true molars. It is an exaggerated form of the *M. subtrigonus.* The internal angle of the V, as well as the intermediate tubercles at the ends of its limbs, are distinct. Cingula extending entirely round the crown, the posterior with a small tubercle on the M. II as in *A. subtrigonus*; none on M. III, which is .75 the area of the M. II. Diameters M. II, anteroposterior, .008; transverse, .010. Diameters M. III, anteroposterior, .007, transverse, .009. From the Lowest Puerco of New Mexico, D. Baldwin.

*Mioclænus opisthacus*, sp. nov.— The species of this genus brought thus far from the Puerco formation have no internal cusp, but a ridge on the internal side of the heel of the inferior true molar teeth. The *M. brachystomus* of the Wasatch has such a cusp. The present species from the Puerco also possesses this cusp. It differs from the *M. brachystomus* in its much larger size and more robust premolars. The latter are, however, less robust than in *M. turgidus* and have an oval anteroposterior section. The fourth has a small heel, but no anterior basal lobe. The true molars are of subequal size and not smaller than the premolars. No anterior inner nor posterior median cusps. Length of last four molars, .025; do. of P-m. IV, .006; of last true molar, .0065. Depth of ramus at M. II, .0116. Three individuals.

*Mioclænus baldwini*, sp. nov.—The description of the last species applies to this one in many respects, including the posterior inner lobe of the inferior true molars, but the size is less, and the last inferior molar is materially smaller. There is also a well defined anterior internal cusp on the second true molar. The ramus becomes quite slender anteriorly. Length of last six molars, .035; do. of last four, .022; do. of P-m. IV, .0057; do. of M. I, .0053; do. of M. III, .0055. Dedicated to D. Baldwin, the discoverer of the Puerco fauna.

*Protogonia plicifera*, sp. nov.—This, the second species of the genus, differs from its congener, *P. subquadrata*, in that the inter-

nal cusp of the fourth superior premolar is connected with the anterior and posterior cingula by strong ridges, becoming thus the apex of a V. In the *P. subquadrata* it is a simple cone. Antero-external basal lobe distinct, intermediate lobe obsolete. The true molars are like those of the *P. subquadrata*, but all the molars are of smaller size. Length of P-m. IV, plus M II and M. III, .0215; diameters P-m. IV; anteroposterior, .006; transverse, .007; do. of M. II, .0095 and .008. D. Baldwin.

*Dissacus carnifex*, sp. nov.—This creodont differs from its only congener in its greater size, and in the presence of an anterior basal lobe on the third inferior premolar. This is wanting in *D. navajovius*. As compared with the latter the six inferior molars are as long as its seven, and the mandibular ramus is much deeper. Like it the P-m. IV and the true molars have an anterior basal tubercle: and the last two true molars have an internal supplementary cusp. After the *Sarcothraustes antiquus*, the largest flesh-eater of the Puerco. Length of last six molars, .075; of true molars, .038; of P-m. IV, .0125; of M. II, .0135; of M. III, .0130. Depth of ramus at M. II, .029. Upper Puerco, D. Baldwin.—*E. D. Cope.*

GEOLOGICAL NEWS—The July number of the *American Journal of Science* contains a succinct account of the phenomena of metalliferous vein formation now in progress at Sulphur Bank, near Clear lake, Cal., including a description of the geology of the vicinity, by Professor Joseph Le Conte. To the same magazine Rev. A. A. Young contributes observations on the crystallized sands of the Potsdam sandstone of Wisconsin; and G. K. Gilbert writes upon the origin of jointed structure, combating the theory of Professor John Le Conte, who in the March number of the same magazine explains the jointed structure of the Quaternary clays of the Great Salt Lake desert by referring it to the same category with shrinkage cracks observed in recent Californian alluvial deposits. Shrinkage cracks form four to seven sided irregular masses, the included angles varying greatly, whereas the joints of indurated rocks are characterized by parallelism, and the lines of two systems of joints cross each other, which is not the case in shrinkage cracks. Mr. Gilbert then takes up the theory which classes joints with slaty cleavage, and attributes them to lateral compression. As it appears improbable that a broad sheet of fresh-water sediments, so fresh that the shore-trace of the formative lake has scarcely been impaired by the weather, should have been laterally compressed in two directions nearly at right angles to each other so as to form the two systems of joints which exist in it, and as, moreover, only a single system of joints exists in the Triassic and Jurassic sandstones of the Colorado plateaus, Mr. Gilbert dismisses this theory also as untenable, and regards the question as still an open one.——The

Report upon the Geology and Mining Industry of Leadville, Col., by S. F. Emmons, contains thorough details of the Palæozoic and eruptive Mesozoic rocks of the district, and of the ores, which principally occur underneath a porphyry sheet and chiefly in cavities penetrating the "Blue" limestone, the lowest member of the carboniferous.

## MINERALOGY.[1]

CHROME TOURMALINE. — Cossa and Arzruni describe in the *Zeitschrift fur Krystallographie* a new variety of tourmaline, in which chromic oxide replaces a portion of the alumina. The tourmaline, of a deep green color, occurs in deposits of chromic iron in the Ural mountains. The crystals have a beautiful dichroism, appearing, when viewed by daylight, yellow brown, parallel to the optic axis, and blue-green at right angles to the axis. Viewed by lamplight the yellow-brown color changes to ruby-red, and the green color nearly disappears. The result is, that the crystals are green by daylight and intense red by lamplight—a phenomenon shared by alexandrite.

The chrome tourmaline has a specific gravity of 3.120. Before the blowpipe it melts somewhat easily to a grayish-white, opaque bead. With borax and salt of phosphorus it gives a fine green bead, and in the latter flux a skeleton of silica. It is only decomposed by acids after fusion. The analysis was as follows:

| $SiO_2$ | $Bo_3$ | $Al_2O_3$ | $Cr_2O_3$ | FeO | MgO | CaO | NaO | $H_2O$ | F | |
|---|---|---|---|---|---|---|---|---|---|---|
| 36.79 | 9.51 | 30.51 | 10.86 | 2.91 | 4.47 | .72 | 1.36 | 2.25 | .65 | = 100.08 |

It is to be classed in the third group of tourmalines of Rammelsberg's classification.

PARAFFINE IN LAVA.—O. Silvestri has found that the basaltic lava in the neighborhood of Etna, contains small geodes filled with solid crystallized paraffine. The paraffine is in large translucent plates of waxy appearance and yellowish-white color, with a melting point of 56°. It is soluble in ether and in boiling alcohol.

NEW LOCALITIES. — A. Schmidt describes small transparent crystals of *newberyite* from Mejellones, Chili. They occur in crevices in guano, and having bright lustrous faces, could be accurately measured in the reflecting goniometer. They are orthorhombic in tabular crystals, with a hardness somewhat more than 3, and a specific gravity of about 2.10. Newberyite had previously been found in Victoria, Australia.

Damour gives an analysis of *fuchsite* from the Urals, and Arzruni describes its physical properties.

*Mendozite*, a sodium alum, occurs in the province of Idzumo, Japan, in considerable quantity, as an efflorescence upon albite.

[1] Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

It is found in two forms, the one massive, finely fibrous, grayish-white and translucent; the other as friable opaque tears slightly colored by iron salts. It contains, as shown by Dr. Divers, twenty-four molecules of water, and is thus of the normal type.

A RELATION BETWEEN THE OPTICAL AND CHEMICAL PROPERTIES OF PYROXENE AND AMPHIBOLE.—F. J. Wiik has found a very interesting relation between the optical and chemical properties of the pyroxenes and amphiboles of Finland. The angle between the axes of greatest and least elasticity has a direct relation to the amount of ferrous oxide in pyroxene or the amount of alumina in amphibole, the angle becoming larger as the percentage of these substances increases.

Specimens from a large number of localities were examined with unvarying result. The following are examples:

| Locality. | Optic angle. | Percentage of FeO. |
|---|---|---|
| PYROXENE. | | |
| Wampula (yellowish malacolite) | 37° | .99 |
| Karis-Lojo (gray-green malacolite) | 39° | 2.68 |
| Helsingfors (green pyroxene) | 42° 30′ | 10.38 |
| Pargas (black augite) | 43° 30′ | 15.75 |
| Lojo (black malacolite) | 48° | 27.50 |
| AMPHIBOLE. | | |
| Orijäroi (light-green actinolite) | 17° | 1.69 |
| Orijäroi (dark-green actinolite) | 18° 30′ | 5.10 |
| Pargas (black hornblende) | 24° 30′ | { 11.92<br>13.75 |
| Korpo (light-green hornblende) | 27° 30′ | { 20.10<br>20.73 |

NEW MINERALS.—Two new minerals from Wermland, Sweden, are described by Igelström:

*Manganbrucite.*—This is a massive, uncleavable substance of a yellow or brownish-red color, which occurs in small grains imbedded in the manganese ore of the Jakobsberg mines. It is associated with a number of manganese minerals. It contains

| MgO | MnO | $H_2O$ | | |
|---|---|---|---|---|
| 57.81 | 14.16 | 28.00 | = | 99.97 |

If a pure substance, and found to be of constant composition, it may be classed as a massive manganesian variety of brucite.

*Talktriplite.*—This is also a massive substance of yellow or yellowish-red color occurring in grains the size of a pin head at Horrsjöberg. It is transparent, has a hardness of about 5, and contains phosphoric acid, iron, manganese, lime and magnesia, with some fluorine. As it was not separated from its matrix, no analysis of the pure substance was made. It is supposed to be a triplite containing lime and magnesia, but further examination seems to be necessary before classing it among accepted species. It occurs with lazulite, svanbergite and other phosphates.

DIABANTITE-VERMICULITE.—Professor B. K. Emerson describes a *diabantite-vermiculite* from a dyke of diabase near Turner's

Falls, Connecticut. The foliated chlorite known as diabantite frequently decomposes and then contains amygdules filled with a bronze-yellow substance which exfoliates largely before the blowpipe. The diabantite itself is regarded as an original product of the decomposition of the trap while still hot, while the so-called diabantite-vermiculite is of much more recent origin, being due to atmospheric alteration.

Salt water in Sulphur Crystals.—Many of the flat crystals of sulphur from Catania, Sicily, contain enclosures of a colorless transparent liquid, in which gaseous bubbles may frequently be seen. Microscopic tubular cavities also traverse the flat laminæ of the crystalline masses of sulphur. Sylvestri finds the enclosed liquid to be a weak aqueous solution of sodium chloride and sulphate, with traces of potassium, calcium, barium and strontium chlorides. The total saline matter amounted to slightly over one per cent.

The Dispersion of Chromate of Soda.—M. Wyrouboff has shown that crystals of chromate of soda having four per cent. of water have very remarkable optical properties. When examined with converging polarized light a plate of this salt shows a curious system of curves very differently arranged on either side of the bissectrix. In the last number of the Bulletin of the Mineralogical Society of France, colored plates are given illustrating the irregular figures produced by polarized light. The irregularity of the curves is due to inclined dispersion combined with considerable difference in the position of the planes of the axes for different colors. It is a very striking example of inclined dispersion, no other substance being known to possess it to such a degree.

Aluminium as a Blowpipe Support.—The use of a plate of aluminium as a support for the assay in blowpipe operations, as advocated by Col. W. A. Ross, appears to possess a number of advantages over the usual block of charcoal.

The *black* sublimates formed by arsenic, antimony, lead, etc., invisible upon charcoal, can be distinguished upon the new support. Any sublimates formed can be scraped off in a pure condition for further examination, whereas upon charcoal there is always an admixture of ash. The danger of loss of the sublimate or assay, either by cracking of the charcoal, by blowing away, by admixture with white ash, or by re-sublimation on the incandescent charcoal, is greatly lessened by the use of aluminium as a support, and more minute quantities of a substance may thus be detected.

In practice, it is often necessary to place a small slip of charcoal between the assay and the aluminium plate, in order to obtain a sublimate.

The superior heat conduction of aluminium prevents it from combining with fusible metals, as is the case with platinum. For

the same reason aluminium foil is stated to be better fitted than platinum foil for the fusion of alkaline carbonates, the detection of manganese, etc.

ERSBYITE.—This feldspar, hitherto regarded as an anomalous variety of doubtful existence, has recently been shown by F. J. Wiik, to be a potash microcline. The large percentage of lime given in former analyses is proved to be due to an admixture of calcite. After purification in weak acid, the following composition was found:

| $SiO_2$ | $Al_2O_3$ | $CaO$ | $K_2O$ | $Na_2O$ |
|---|---|---|---|---|
| 66.18 | 19.52 | .36 | 13.03 | .91 |

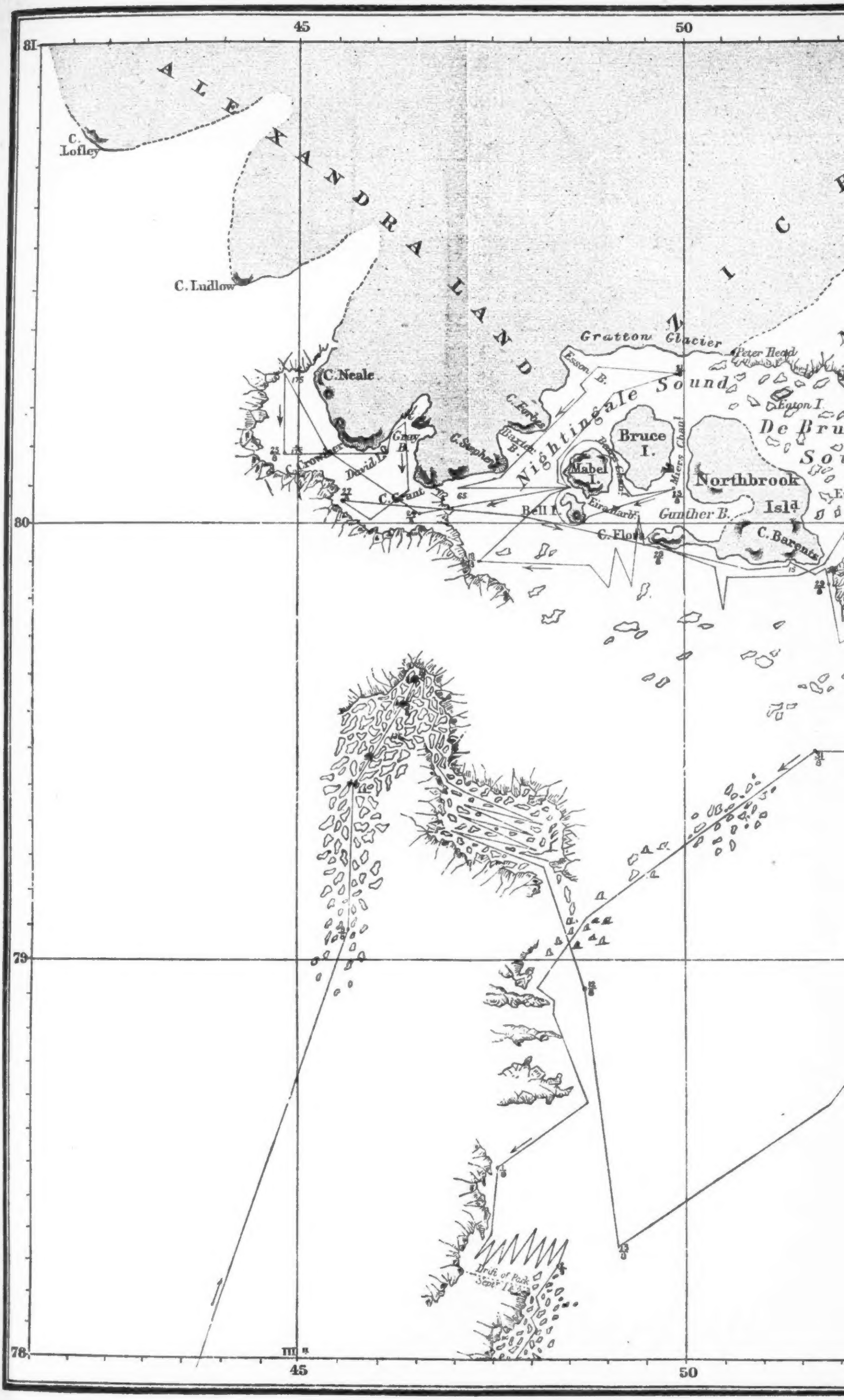
The feldspar occurs in colorless crystals at Pargas, Finland, and is intimately associated with another feldspar, now shown to be andesite. The optical properties are identical with microcline, and the name ersbyite must be dropped from the list of species.

MINERALOGICAL NOTES.—N. H. Darton is giving, in the *Scientific American Supplement*, a popular account of the mineral localities and the minerals to be found in and around New York city. The articles are written in a familiar style, and will be of great assistance to beginners in mineralogy living near New York city. Professional mineralogists also will be glad to know the exact localities of the specimens in their cabinets, and will be interested in the full description of their method of occurrence.——The Proceedings of the Mineralogical and Geological Section of the Academy of Natural Sciences of Philadelphia are offered for sale at fifteen cents.——Crystallographers will be interested in the abnormal *diamond* crystals recently described and figured by Purgold of Dresden. One of these has eight projecting triangular points—the result of repeated twinning.——The second part of Professor Tschermak's "Lehrbuch der Mineralogie" (Vienna) has recently been issued. It is a valuable work, embodying the latest results of mineralogical research.——Selenium and tellurium have been found in the sulphur of Japan.

## GEOGRAPHY AND TRAVELS.[1]

THE RESCUE OF THE CREW OF THE EIRA.—The steam whaler *Hope*, Captain Sir Allen Young, which sailed from the Scotch port of Peterhead about June 20th, to search for and relieve the crew of the *Eira*, has been most successful in its mission, having returned with all the members of the missing expedition on board. The *Eira* left Peterhead on the 14th of June, 1881. The ice that season reached very far south, and no opening could be found to enable her to get north until the middle of July. Franz-Josef's Land was reached on July 23, and the *Eira* steamed along the coast to within fifteen miles of Cape Ludlow. The ice was closely packed to the north, so it was decided to return to Gray

[1] Edited by ELLIS H. YARNALL, Philadelphia.


45
50
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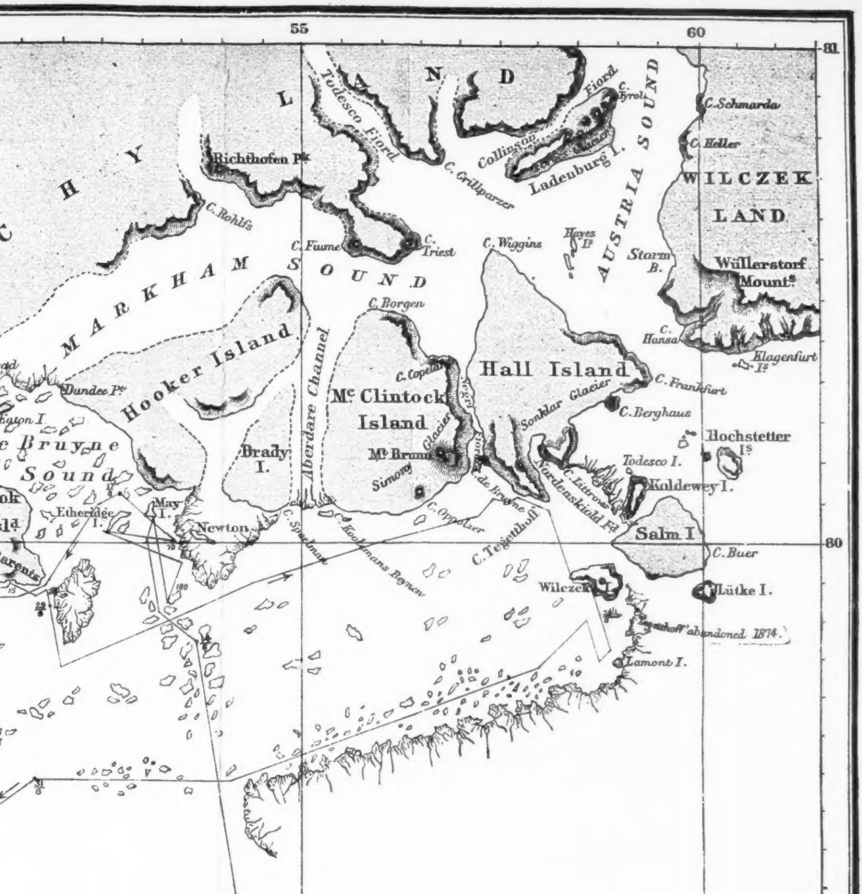
ALEXANDRA LAND
C. Lofley
C. Ludlow
C. Neale
C. Crowther
David B.
Gray B.
C. Grant
C. Stephen
C. Forbes
Barton B.
Esson B.
Gratton Glacier
Peter Head
Nightingale Sound
Bruce I.
Mabel I.
Eira Harb.
Bell I.
Miers Chan.
Eaton I.
De Bru
Sou
Northbrook Isld
Gunther B.
C. Flora
C. Barents
Drift of Pack




DISCOVERIES
along the
SOUTH COAST
OF
# FRANZ-JOSEF LAND
by Mr B. Leigh Smith,
1880.

Bay and wait till a more favorable opportunity should present itself to proceed. On August 7 the *Eira* was made fast to the land floe near Bell Island, and a store house was erected of materials taken out of the *Eira*. On August 15 the *Eira* left Bell Island and being unable to pass to the eastwards of Barents Hook, she was made fast to the land floe off Cape Flora. The next few days were spent in collecting plants and fossils, which unfortunately were lost with the vessel. On August 21 the *Eira* was heavily nipped by the ice, and about 10 A. M. a leak was discovered. The *Eira* sank in two hours time, before many stores were saved. A house was built on Cape Flora of stones and turf, and covered with sails, and the winter was spent there. The party depended chiefly for food on the bears and walrus. Thirty-six bears and twenty-nine walrus were killed and eaten. Large numbers of walrus appearing in June, they were enabled to lay in provisions for two months and started in four boats on June 21, 1882, for Novaya Zemlya. Eighty miles of water was encountered before reaching ice. Then the troubles began, and six weeks of constant toil followed until the open water was again found, and within twenty-four hours of leaving the ice the four boats, with their crews of twenty-five in all, were safely landed upon the beach at Matyushin Strait on the evening of August 2, where they were found the next day, first by the Dutch expedition in the *Willem Barentz*, and then by the *Hope*. The *Hope* arrived at Peterhead on August 20, within a few hours of the anniversary of the day when the *Eira* was lost.

There seems now no reason to doubt that at some period of every summer, Franz-Josef Land is accessible without great difficulty, and it undoubtedly presents, at present, the most inviting and encouraging field for Arctic exploration for the purpose of reaching the most northern latitudes.

ARCTIC EXPLORATION.—Lieutenant Hovgaard, formerly of the Nordenskiöld Expedition, will sail early in June, from Copenhagen, in the steamer *Dympna* for Cape Chelyuskin, afterwards endeavoring to reach Franz-Josef Land.

Remains of Northmen have been found on the east coast of Greenland in lat. 60° 31′ N. The building discovered is forty paces long by ten wide, and its foundations consist partly of stones of cyclopean dimensions. There are similar ruins, the natives report, in lat. 60° N.

Immense ice-floes filled the sea between Spitzbergen and Iceland in June. In Iceland large districts are said to be suffering from famine, as the vessels are unable to land the provisions on the customary arrival of which they depended. The severity of the weather is preventing the growth of the crops, and large numbers of sheep and ponies are dying.

Baron Nordenskiöld has published the first volume of the "Scientific Results of the *Vega* Expedition." It covers 800 pages

with maps and tables. There are papers on the aurora, the health of the expedition, the color sense of the Chukchis, on the botanical collections, meteorological observations, the Invertebrata of the Arctic Seas, etc.

*Nature* states that the French Government is making preparations to send out an Antarctic Expedition to Cape Horn. The expedition will be fitted out for a period of eighteen months, and 2,500,000 francs have been voted for it.

Recent explorations in the Argentine portion of the Terra del Fuego show an abundant occurrence of gold.

Deep Sea Explorations. — The president of the English Geologists Association in his recent address before that Society, has given a valuable account of deep sea explorations from Capt. Dayman's survey of the North Atlantic sea bed in 1857, to the expedition of the *Challenger*.

The French Commission will continue their deep sea explorations on board the *Travailleur* during this season. The investigations will include the ocean bed along the coast of Spain, Portugal and Morocco.

Ascent of Mount Cook.—The Rev. W. S. Green and his two Swiss guides, succeeded in ascending Mount Cook, the highest known Australasian peak, on the 2d of March last, after two unsuccessful attempts. Great danger was incurred from continual avalanches, and the summit was not reached until 6.20 P.M. As the clouds obscured the view and the hour was so late only ten minutes were spent on the summit and no observations appear to have been taken so that the actual height of Mount Cook is still unknown. It is given in the government map as 12,349 feet. In the account given in the *Proceedings* of the Royal Geographical Society it is said: "The scenery about the upper part of the Tasman Glacier and its branches, is described as supremely grand, equaling and even excelling the most famous scenery in the European Alps. The peaks rise higher above the level of the snow fields, and these are more extensive, and under the brighter and clearer atmosphere of New Zealand, present a more dazzling beauty. The spurs of Mount Cook, below the snow line, were covered with plants which reminded the travelers of the Alpine vegetation of Switzerland. Among these was a Gnaphalium closely resembling *G. leontopodium*, the well-known 'Edelweiss.'"

Afghanistan.—During the recent occupation of Afghanistan by the English, an area of 39,500 square miles has been surveyed in more or less detail, in various parts, and a further area of about 7000 square miles has been explored by native agency. An important result of these surveys is to show that the position of Kabul, Ghazni and Kandahar, as indicated previously on the maps, are correct in latitude but erroneous in longitude by ten to fourteen miles, and that they all require to be shifted to the east,

bringing them so much nearer to the British frontier. A large number of the heights are found to be considerably in excess.

## MICROSCOPY.[1]

BIBLIOGRAPHY OF THE MICROSCOPE. — Mr. Julien Deby, of London, late vice-president of the Belgian Microscopical Society, has commenced the publication, under this title, of a most useful work. Part III, relating to the Diatomacea, has appeared, Mr. Frederick Kitton having assisted in its preparation. Parts I and II, relating to the microscope proper, the Protozoa, the Desmidiæ, etc., will shortly follow. In preparing for his own convenience this catalogue of the books and papers in his microscopical library, Mr. Deby has with much labor prepared a catalogue which, with its added desiderata, constitutes a very complete microscopical bibliography. The work includes reference to papers in journals and transactions; and also contains a chronological index to all the publications referred to. It is handsomely printed for the author, and the necessarily limited edition has been generously distributed by him in the hope of making it useful to microscopical friends—a hope which will be abundantly realized.

APPARENT SIZE OF MAGNIFIED OBJECTS.—Professor Wm. H. Brewer read a paper upon this subject at the recent meeting of the A. A. A. S. The well known diversity of opinion as to the apparent size of an object under the microscope was illustrated by reports of experiments upon over 400 observers of all classes, ages, occupations and qualifications. The object was a common louse magnified, as estimated by scientific microscopists, to the size of 4.66 inches. By far the greater number of observers underestimated this value; two estimates were only one inch, while seven were over a foot, and one (by an expert draughtsman) was at least five feet. Among new students the first impression was usually somewhat larger than the real value, and this was adhered to for some time.

DOUBLE-STAINING OF NUCLEATED BLOOD CORPUSCLES.—Dr. Allea Y. Moore gives, in *The Microscope*, a valuable explanation of the method of differential staining by which his fine slides of blood corpuscles are produced. The blood is spread upon the slide by the usual method, drawing a drop across one slide by means of the edge of another slide. When the film of corpuscles, thus evenly spread, is thoroughly dry, the slide is flooded for three (3) minutes with a solution of rosin five grains, in distilled water and alcohol, four drachms each. The slide is then washed by passing it gently through clean water, and before drying is flooded for two (2) minutes with a solution of methyl analine green five grains, in distilled water one ounce. It is then

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

washed again, as before, and set aside to dry, and finally mounted in Canada balsam warmed just sufficiently to spread properly. Corpuscles prepared in this way will be found to be stained red, while the nuclei and leucocytes will be a bluish-green, and will show with great sharpness and brilliancy under the microscope.

Mounting with black Background.—On principle, I very much dislike to see objects mounted with an irremovable *black background.* When it is desirable to view objects as opaque, there are so many other ways of doing this, *e. g.*, the diaphragm, or the dark well of the opticians, or a piece of dead-black paper, cloth or velvet placed behind the slide; it can then still be viewed as a transparent object also. Otherwise it is the mounter saying to the observer: "You shall see my slide as *I* will, and in no other way."—*Tuffen West in Journal of the Postal Microscopical Society.*

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## SCIENTIFIC NEWS.

— A specimen of the Gila monster, a large lizard, *Heloderma horridum*, has been recently added to the Zoölogical Garden at London, according to *Land and Water.* This lizard is reported to be poisonous. We remember visiting one which lived loose for a number of months in the front window of an apothecary's shop in Salt Lake City, which showed slight, if any, evidence of ferocity, its keepers not being aware of its reported poisonous qualities. Dr. Irwin, U. S. A., experimented with the *H. suspectum* in Arizona, fifteen years ago, and concluded that it was harmless. The London individual was tested with a frog, which died after a few voracious bites, and then a guinea pig, which was convulsed and died in three minutes after one bite in the leg; but this might happen if this large lizard was not poisonous, and there is room for more careful experiments as to its venomous qualities.

— Mr. Herbert Spencer, the leading philosopher of England, if not of the world, has been in this country for some weeks, the guest of Dr. Youmans, the editor of the *Popular Science Monthly.* Mr. Spencer, it is understood, will not lecture while in the United States, as he is traveling for his health. While few will probably have the pleasure of meeting this great thinker and organizer of new lines of thought which have already revolutionized social as well as physical science, it is a great pleasure to have him among us, and we feel sure that every one will earnestly hope for his full restoration to health and former capacity for work.

— Professor R. Ellsworth Call has met with good success in his collecting tour in the Gulf States, having obtained a large number of the *Strepomatidæ*, a group of shells which he intends to monograph. He designs not merely to systematize the group, but to give their anatomy, development if possible, distribution, habits, &c., &c. He has already eight-tenths of all the nominal

species, and hopes for the loan of rarities and even common species from conchologists at home and abroad.

— The Darwin memorial fund amounts to £2500, and the memorial will take the form of a marble statue, to be placed in the large hall of the new Natural History Museum at South Kensington.

— Our readers will deeply regret the untimely death of Professor F. M. Balfour, who was killed in July at the age of 31, by a fall on a glacier on Mont Blanc. His career had been a remarkably brilliant one, his work was critical and yet profound, and he had done perhaps more than any one else to advance embryological science in England. His "Comparative Embryology" will be a lasting monument to his genius as an investigator and scholar.

— William Stanley Jevons, professor of political economy in University College, London, was drowned while bathing at Bexhill, near Hastings, England, Aug. 15. His greatest work, "The Principles of Science," gave him a wide reputation; it fully recognized the place of the doctrine of evolution in the philosophy of science. His text book on logic is widely used in American colleges.

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## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Montreal, Aug. 23–30, 1882.—The attendance on this session was nearly a thousand, being almost as many as met at Boston two years ago; the citizens of Montreal gave a most generous and warm reception to the association. The address of the retiring president, Professor Brush, was on mineralogy, its present state and early history in America. The association will meet in 1883 at Minneapolis, Minn., under the presidency of Professor C. A. Young, Principal Dawson having been president of the Montreal meeting.

Professor Wm. B. Carpenter, of England, was present, and delivered an evening lecture on the temperature of the deep sea, and Mr. T. Graham Bell lectured on visible speech. Besides Dr. Carpenter, Professors Szabo from Buda Pesth, W. Kowalevsky of Moscow, and Haughton of Dublin, were present, and assisted at the meeting. On the evening of the 24th the Peter Redpath Museum of McGill University was formally opened. The excursions were a pleasurable feature of the meeting.

Following is a list of the papers read in geology:

### SECTION E—GEOLOGY AND GEOGRAPHY.

On the relations of Dictyophyton, Phragmodictyum and similar forms with Hyphontænia. James Hall.

Note upon the genus Plumulites. James Hall.

A source of the bituminous matter in the Ohio Black Shale (Huron Shale of Newberry). Ed. Orton.

Contribution to Seismology. Richard Owen.
The topography and geology of the Great Salt Lake valley. William Bross.
Pre-glacial channel of Eagle river, Lake Superior. Charles Whittlesey.
Recent discoveries of fossil fishes in the Devonian rocks of Canada. J. F. Whiteaves.
The Eozoic rocks of Central and Southern Europe. T. Sterry Hunt.
The Serpentines of Italy. T. Sterry Hunt.
Note on the occurrence of *Siphonotreta scotica* in the Utica formation near Ottawa, Ont. J. F. Whiteaves.
Arctic explorations in North America. John Rae.
Recent Investigations and palæontological discoveries in the Wappinger limestone of Dutchess and neighboring counties, New York. Wm. B. Dwight.
A *Mastodon americanus* in a beaver dam near Freehold. N. J. Samuel Lockwood.
Silicified stumps of South Park, Col. Robert B. Warder.
On the classification and origin of joint structure. W. O. Crosby.
On the Winooski marble of Vermont, with exhibition of specimens. G. H. Perkins.
The comparative stratigraphy of the crystalline rocks of North Carolina and Canada. Alexis A. Julien.
The genesis of the crystalline iron ores of North Carolina and Northern Michigan. Alexis A. Julien.
Palæozoic floras of Eastern North America and more especially in Canada. J. W. Dawson.
Deep-sea soundings and temperatures in the Gulf Stream off the Atlantic coast, taken under the direction of the U. S. Coast Survey. J. R. Bartlett.
Terraces and beaches about Lake Ontario. Jos. W. Spencer.
Occurrence of Graptolites in the Niagara formation of Canada. Jos. W. Spencer.
On the change of relative level of the ocean and uplands on the eastern coast of North America. Geo. H. Cook.
On a Post-tertiary deposit containing impressions of leaves in Cumberland county, N. J. M. L. Britton.
The origin of joint cracks. H. F. Walling.
The great terminal moraine across Pennsylvania. H. Carvill Lewis.
The Danite beds of North Carolina. Alexis A. Julien.
The Felsite tufa of Colorado. Alexis A. Julien.
Note on the exterior markings of bark of *Lepidodendron chemungense.* E. W. Claypole.
On *Amphicœlia cedarvillensis* from the Niagara group of Cedarville, Ohio. E. W. Claypole.
Note on the fauna of the Catskill red sandstone. E. W. Claypole.
A rocking stone in New York city. Chas. H. Graham.
Occurrence of magnetic ore deposits in Victoria county, Ontario. W. Hamilton Merritt.
The undulations of the rock-masses across Central New York State. Henry S. Williams.
Fresh-water lignitic series of beds in the Cretaceous formation of France. D. W. Kowalevsky.
On the surface limit of the thickness of the Continental glacier in New Jersey and adjacent States, with notes on glacial phenomena in the Catskills. John C. Smock.
Suggestions as to the history of the Lower Coal measures of Ohio. Edward Orton.
The glacial flood of the Connecticut River valley. C. H. Hitchcock.
Some mooted points in American geology. J. S. Newberry.
Genesis of North American flora. J. S. Newberry.
Currents of air and ocean in connection with climate, regions of summer rains and summer droughts. J. Beaufort Hurlbert.
Subterranean map-making, with new maps of Mammoth and Luray caves. Horace C. Hovey.
Law of fracture or fissuring, applied to inorganic and organic matter. Richard Owen.
The caves of Staffa and their relation to the ancient civilization of Iona. F. Cope Whitehouse.
On the association of crystals of quartz and calcite in parallel position. R. B. Hare.